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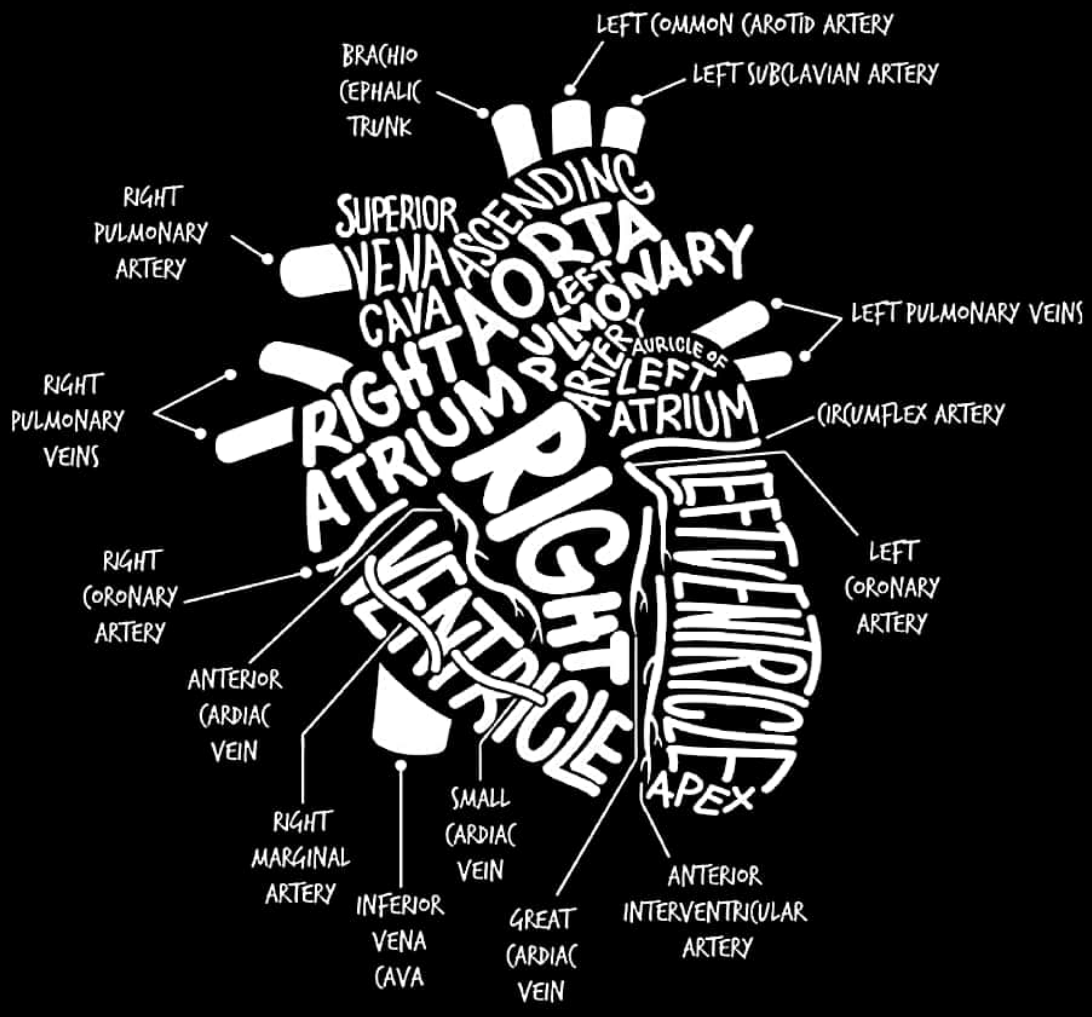
ANATOMY PURE

Based on Marrow 4.0

Lower Limb and Back



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Please Note:

- This is the *digital handwritten* notes of **Anatomy Pure based on Dr. Raviraj's Marrow 4.0 Videos**
- **All the Slides/ Images/ Diagrams and Graphs discussed by the lecturer is included**
- **All the questions discussed by the lecturer is added**

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71.Stomach and small intestine
72.Large intestine
73.Liver and Extra hepatic biliary apparatus
74.Pancreas and Spleen
75.Renal system
76.Blood vessel's of abdomen
77.Perineum
78.Prostate ,Urethra and Scrotum
79.Uterus

Lowe limb

80.Cutaneous innervation of Lower limb ,lumbar plexus ,GSV
81.Front of Thigh and adductor compartment
82.Gluteal region and Back of Thigh
83.Knee joint
84.Anterior and posterior compartment of leg
85.Blood supply Arches and sole of Foot

Back

86.Back
87.General anatomy

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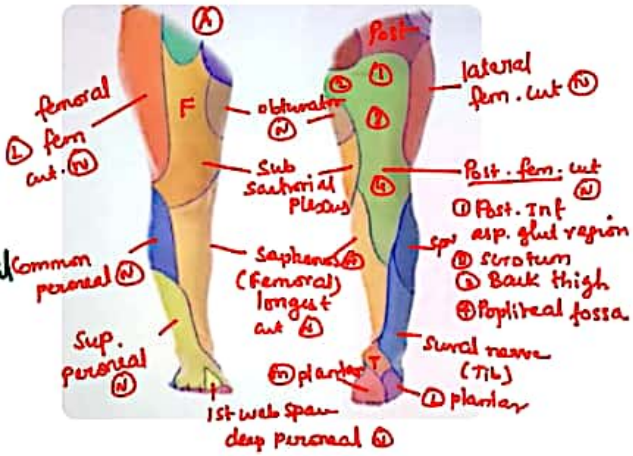
LOWER LIMB

Cutaneous Innervation of Lower Limb, Lumbar plexus & GSV

Cutaneous innervation of lower limb:

Thigh:

Lateral: lateral femoral cutaneous nerve
Medial most: obturator nerve
Medial aspect: subsartorial plexus
In posterior aspect: posterior femoral cutaneous nerve

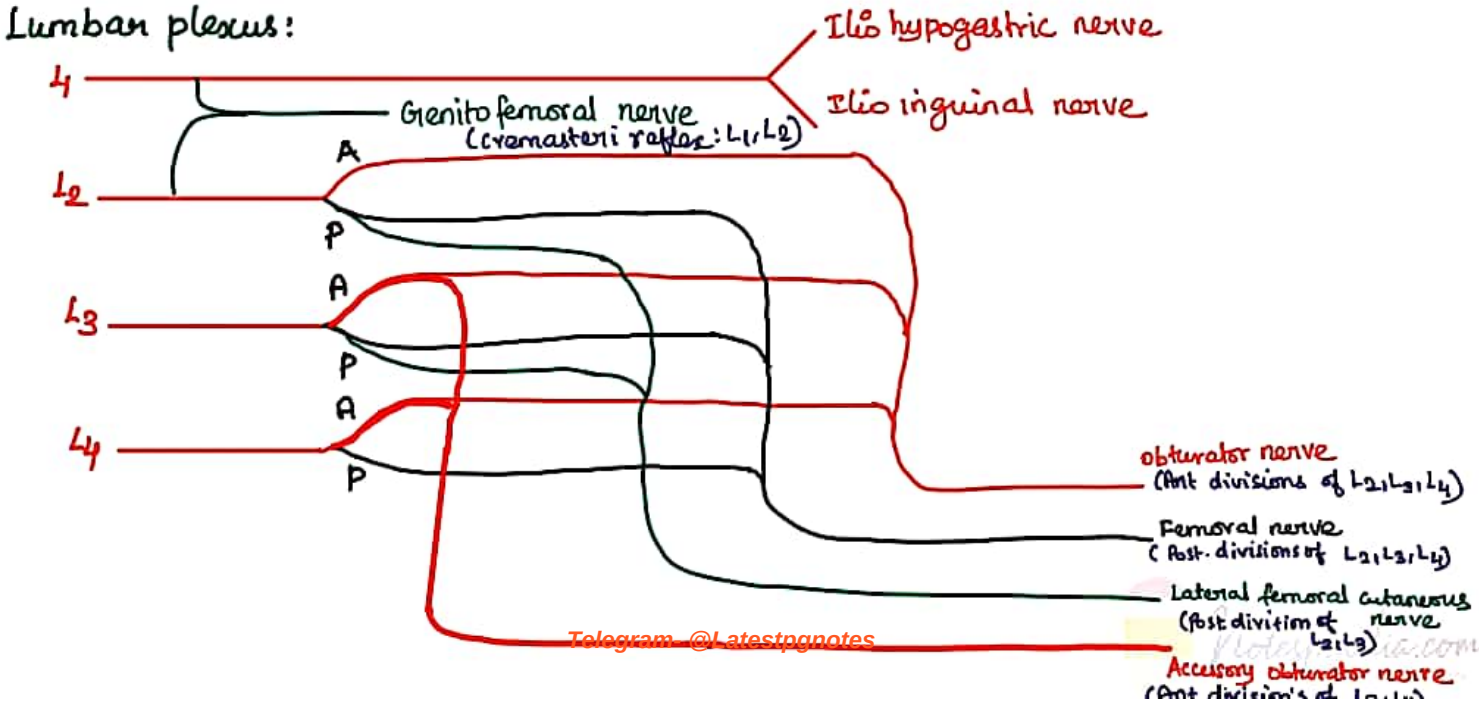


Supplies:
1. Postero inferior aspect of gluteal region
2. Scrotum
3. Back of thigh
4. Popliteal fossa

Leg:

Medial: Saphenous nerve (femoral nerve) → longest cutaneous nerve
Lateral: Common peroneal nerve
Dorsum: Superficial peroneal nerve (except 1st web space)
↳ 1st web space: Deep peroneal nerve
Back: Sural nerve
Heel: Tibial nerve
Sole:
- medial side: medial plantar side
- Lateral side: Lateral plantar side

Lumbar plexus:



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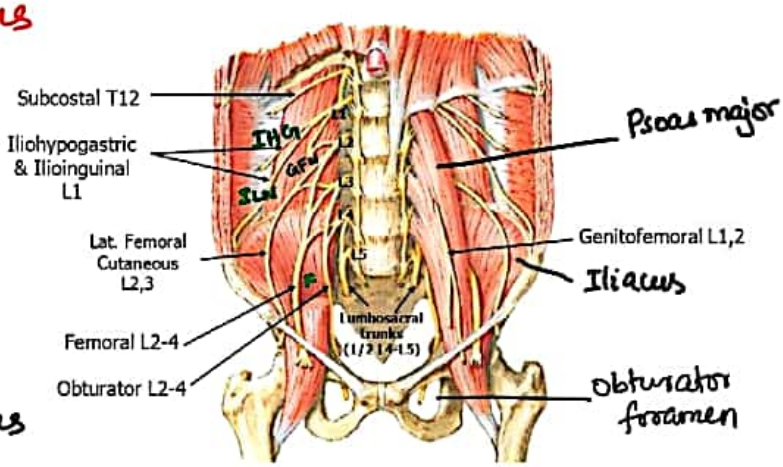
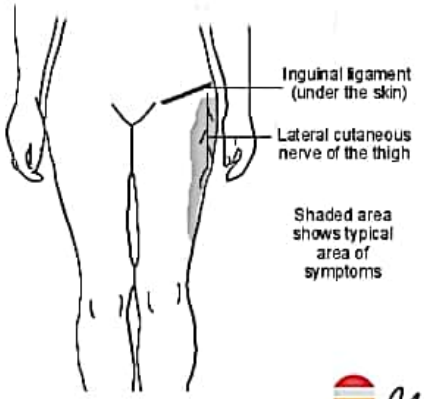
L4 + L5 → lumbosacral plexus
↓
Sacral plexus

L4 is involved in both lumbar and sacral plexus →
Nervus furcalis
IHG - Iliohypogastric nerve
IIN - Ilioinguinal nerve
F - Femoral nerve
(L) fem cut - Lateral femoral cutaneous nerve



Lateral femoral cutaneous nerve:

Passes:
- Behind inguinal ligament
(or)
- Through inguinal ligament



Nerve on irritation → loss of sensation in lateral most aspect of thigh
↓
Meralgia Paresthetica

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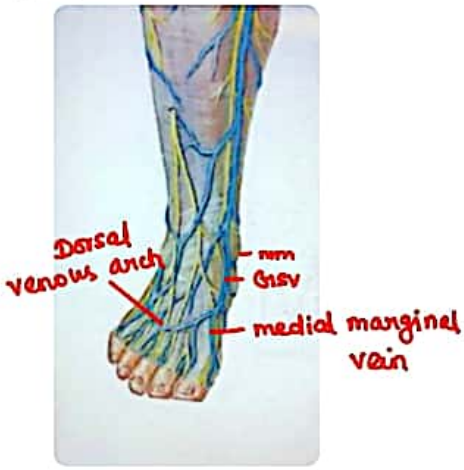
Great saphenous vein:

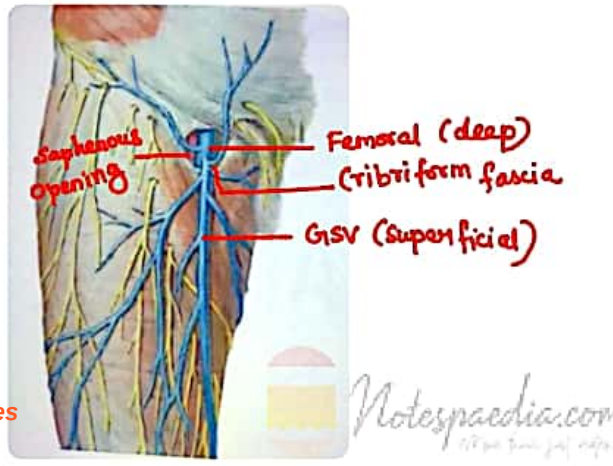
Formation: medial marginal vein + Dorsal venous arch
↓
Great saphenous vein (GSV)

GSV passes 1.25cm in front of Medial malleolus
GSV accompanied by Saphenous nerve
(during venesection of GSV, Saphenous nerve is damaged)
GSV (superficial vein)
↓ Drains to (piercing cribriform fascia at Saphenous opening)
Femoral vein (Deep vein)



Perforators:
Connect superficial veins to deep veins
At different levels

- mid thigh (1) : Hunterian
- above knee (1) : Dodd
- Below knee (1) : Boyd
- Ankle (3) : cocketts



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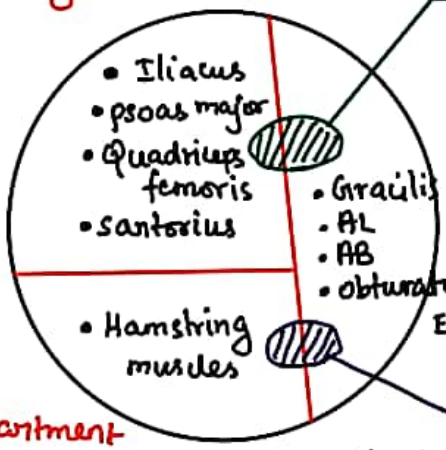
Front of Thigh and Adductor Compartment

Compartment of thigh region:



Femoral nerve → Front of thigh

Adductor compartment → Obturator nerve

Tibial compartment of sciatic nerve → Posterior compartment

AL - adductor longus
AB - Adductor Brevis

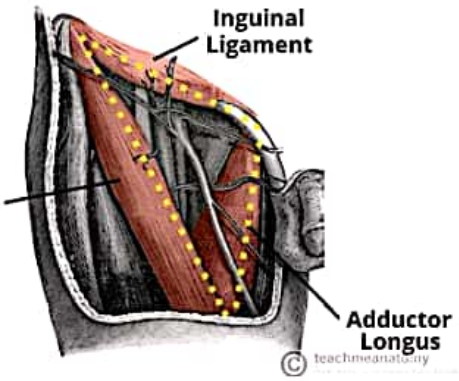
Pectineus muscle:

Function : Flexion and adduction of thigh
Nerve supply : Femoral nerve and obturator nerve
→ Hybrid muscles

Adductor magnus:

Function : Extension and adduction of thigh
Hybrid muscle
Nerve supply : Tibial compartment of sciatic nerve and Obturator nerve

Front of thigh : Femoral triangle:

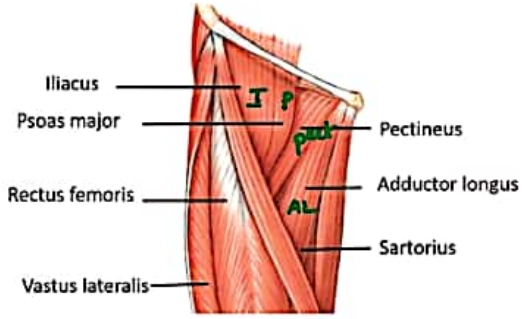


Boundaries:

- Base : Inguinal ligament (anterior superior iliac spine → pubic tubercle)
Medially : medial border of adductor longus
Laterally : medial border of sartorius

Floor contents:

Floor muscles from lateral to medial end:
Iliacus
Psoas major
Pectineus
Adductor longus



Content of the femoral triangle:

Femoral Sheath:
- Facial prolongation over proximal part of femoral vessels.
Anterior wall : Fascia transversalis
Posterior wall : Facia iliaca

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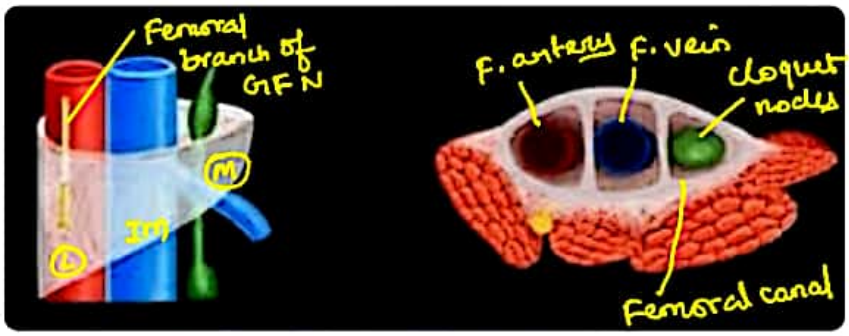
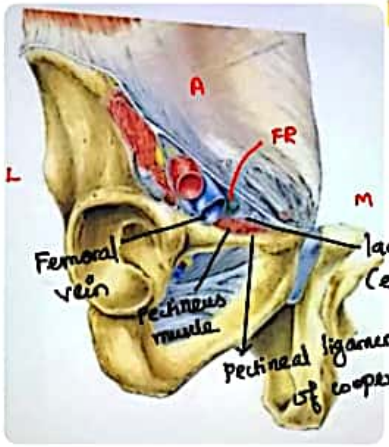
- Femoral sheath is divided into 3 compartments:
- Femoral canal allows expansion of femoral vein
- Femoral canal contains cloquet's nodes (deep inguinal nodes)
- posterior to Femoral sheath: Nerve to Pectineus (branch of femoral nerve)



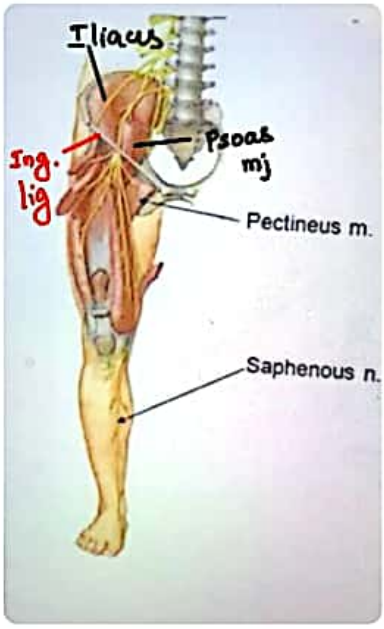
Femoral ring:
Boundaries:
Medially: Lacunar ligament
Laterally: Femoral vein
Antoriorly: Inguinal ligament
posteriorly: Pectineus muscle
- On pectineal line: Pectineal ligament of cooper is attached

FR- Femoral ring wide in females
↓
Femoral hernia is m/c in female

Femoral nerve: outside femoral sheath
Lateral most component of femoral triangle: Lateral femoral cutaneous nerve



Femoral nerve:
Root value: Dorsal division of L_2, L_3, L_4
Mixed nerve
Passes between iliacus and psoas major muscle
Passes below the inguinal ligament
↓
Enters femoral triangle
lies outside femoral sheath



Trunk of femoral nerve
- Branch to Iliacus
- Branch to Pectineus (passing behind femoral sheath)
- Ant division → Lateral Circumflex femoral artery
- Posterior division → profunda femoris artery ← Femoral artery

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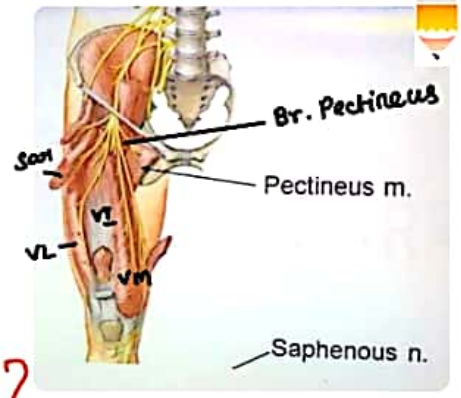
Anterior division: branches:
1) medial femoral cutaneous nerve
2) Intermediate femoral cutaneous nerve
3) Branch to Sartorius muscle



Posterior division: branches
1. Saphenous nerve (longest cutaneous nerve)
2. Branch to rectus femoris
   ↳ Twig to hip joint
3. Branch to vasti medialis
4. Branch to vasti intermedius } Twig to knee joint
5. Branch to vasti lateralis

Quadriceps femoris muscle

Obturator nerve:
Root value: Ventral division of L_2, L_3, L_4
Mixed nerve

Anterior division
→ Passing in front of obturator externus and adductor brevis
→ close to obturator canal
- Twig to hip joint
- Supplies: gracilis pectineus, adductor longus adductor brevis

→ At lower border of adductor longus: anterior division of Obturator nerve + medial femoral Cutaneous nerve + Saphenous nerve } Sub-sartorial plexus ↓ medial aspect of thigh

→ Also Supplies Femoral artery
→ 4 types of branches:
1. Articular
2. muscular
3. Cutaneous
4. Vascular

Posterior division
→ Passing behind obturator externus and adductor brevis
→ muscles supplied:
- obturator externus
- Adductor magnus
- Adductor brevis (if not supplied by anterior division)

→ Passes: through Adductor hiatus ↓ Popliteal fossa (behind knee joint)
→ Supplies knee joint and Popliteal artery
→ 3 types of branches
1. muscular
2. articular
3. vascular branch

Front of thigh: muscles
Quadriceps femoris:
4 heads
- Rectus femoris (origin from anterior inferior iliac spine)
- Vastus medialis

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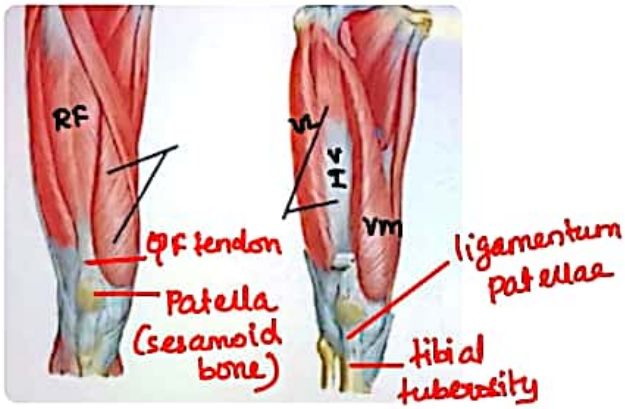
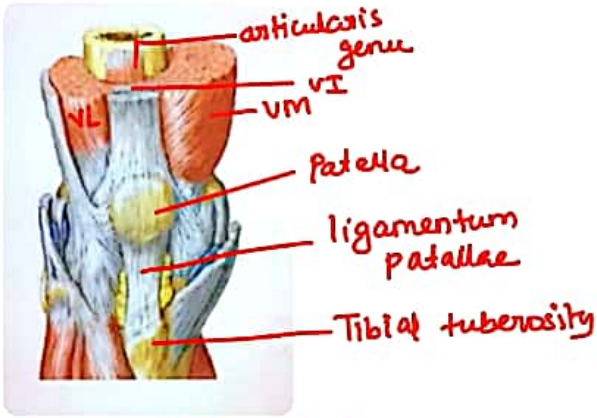
- Vastus intermedius
- Vastus lateralis

- structures attached to Anterior inferior iliac spine (AIIS)
  → Iliofemoral ligament
  → Rectus femoris muscle
- structures attached to anterior superior Iliac spine : (ASIS)
  → Inguinal ligament
  → Sartorius muscle

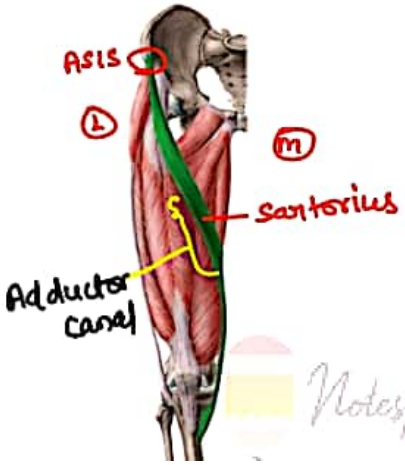
Rectus femoris → crosses hip joint in front → Flexion at hip joint
3 vastus muscles:
Origin : Femur
No action at hip joint
Quadriceps femoris tendon → Patella (sesamoid bone)
Below patella → ligamentum patellae (attach to tibial tuberosity)





Quadriceps Femoris extends the knee : Locking of knee joint
Rectus femoris:
1. Hip flexion
2. Knee extension
Vasti muscles : Extension of knee
Articularis genu:
Detached part of vastus intermedius
Supplied by Nerve to vastus intermedius (branch of femoral nerve

Sartorius muscle:
origin from ASIS (anterior superior iliac spine)
crosses hip joint in front
↓
Flexion, abduction and lateral rotation
Lateral boundary for femoral triangle
Roof of → adductor canal
Along medial side of knee and inserts to medial surface of tibia



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Pes anserinus:

Formed by tendons of : Gracilis
Semitendinosus
Sartorius

Attachments looks like "Goose leg"

Guy ropes muscle:

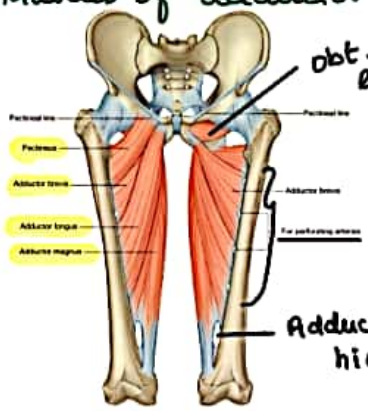
- Gracilis
  Semitendinosus
  Sartorius
- Origin : Hip bone
- Inserted : Tibia
- Act as a rope which ties the hip bone to tibia

Action of Sartorius:

At hip joint: Flexion, Abduction, lateral rotation
At knee joint: medial rotation
flexion:

Muscles attachment of adductor compartment of Hip joint:

Muscles of adductor compartment:



Perforating branch of profunda brachi

Adductor hiatus

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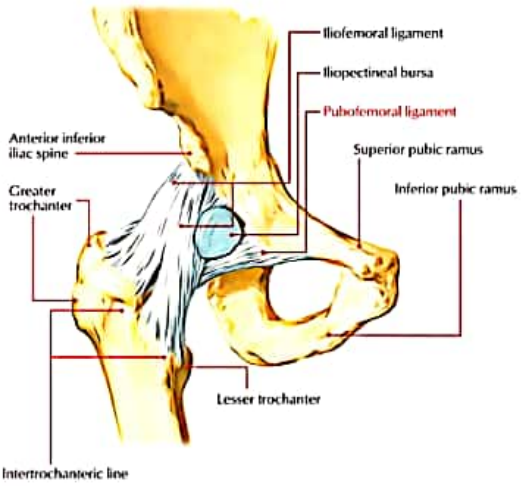
Hip Joint:

Ball and Socket joint

Has acetabulum to which head of femur is articulated

Ligaments:

→ Iliofemoral ligament
aka ligament of Bigelow (strongest lig)
shape → Inverted 'V' shape
Attachment : Anterior inferior illiac spine (AIIS)
to intertrochonteric line
Function : prevents hyperextension of hip joint



→ Pubofemoral ligament:
derived from obturator crest
+
Superior ramus of Pubis
Blends with iliofemoral ligament
prevents hyperadduction of femur

→ Ischiofemoral ligament:
Assist iliofemoral ligament

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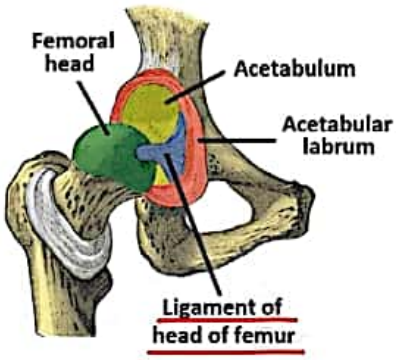
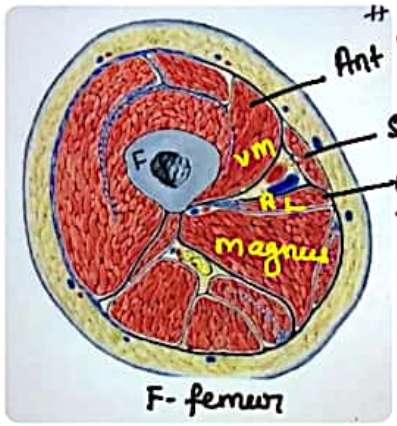
→ Transverse acetabular ligament
→ Ligament of head of femur
Conveys blood vessel (branch of obturator artery)

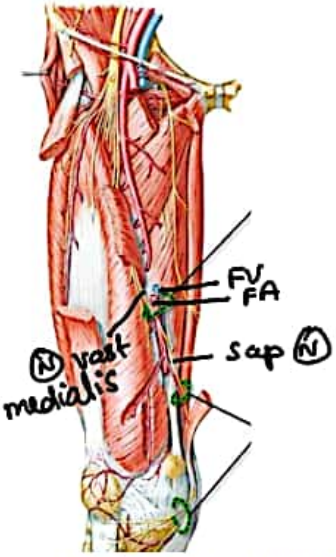


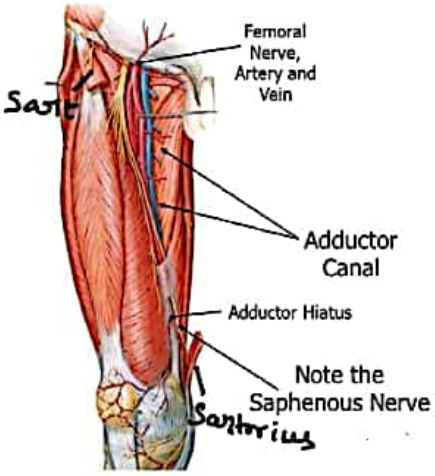
Adductor Canal:

Roof: Sartorius muscle
Anterolaterally: Vasti medialis
posteromedially: Adductor longus
+
Adductor magnus

Content:
- Femoral artery
- Saphenous nerve
- Nerve to Vasti medialis
- Femoral vein







Femoral a/v and saphenous n. enter the *adductor canal*

Femoral a/v exit the canal through the *adductor hiatus*, become popliteal a/v

Saphenous n. (and artery) do not exit the canal through the adductor hiatus
-pierce adductor magnus
-supply cutaneous medial leg/foot

Structures passing through Adductor hiatus:

1. Femoral artery
   → Popliteal artery
2. Femoral vein
   → Popliteal vein
3. Posterior division of obturator nerve

• Saphenous nerve doesn't pass through adductor hiatus

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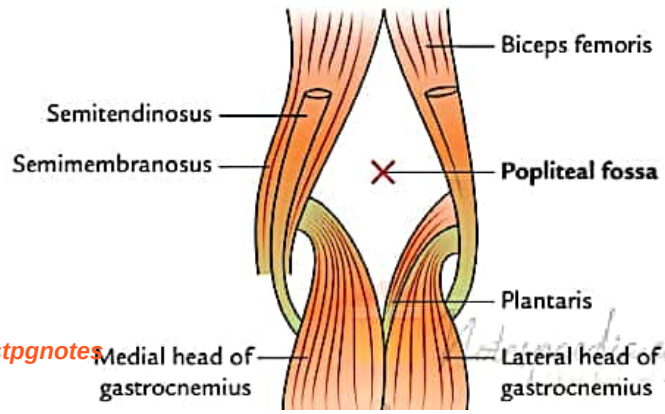
popliteal fossa:

Boundaries:
→ Superomedial:
Semitendinosus
Semimembranosus
→ Supero lateral: Biceps femoris
→ Inferolateral: plantaris
Lateral head of gastrocnemius
→ Inferomedial: medial head of gastrocnemius



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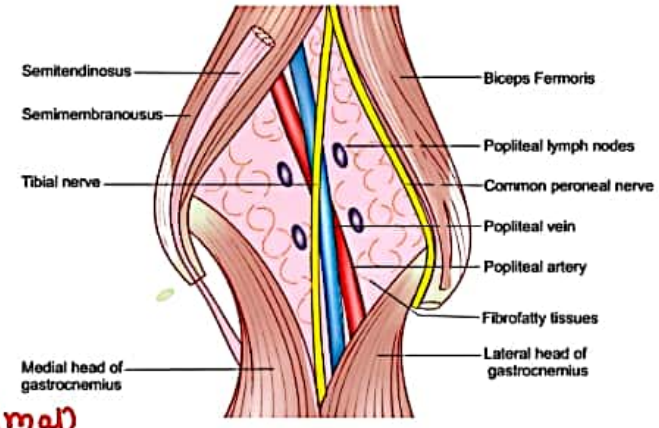
Fabella:

- Sesamoid bone
- Formed in tendon of lateral head of gastrocnemius

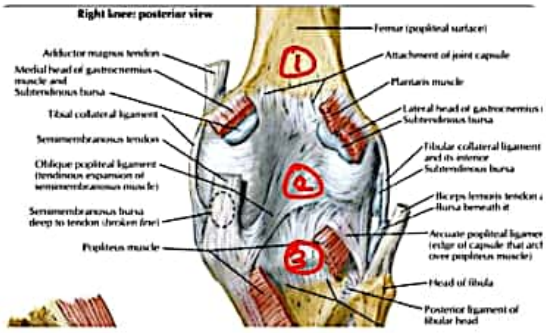


Contents:

1. Tibial nerve crosses popliteal vessels from lateral to medial side
2. common peroneal nerve: medial side of biceps femoris
3. Popliteal vein: Lateral to popliteal artery (Proximal)
   medial to popliteal artery (distal)

Other contents:

1. Posterior femoral cutaneous nerve
2. Posterior division of obturator nerve
3. Small saphenous vein
4. Popliteal lymph nodes
5. medial and lateral Sural nerves



Floor:

1. Popliteal surface of femur
2. Oblique popliteal ligament (from semimembranous)
3. Fascia over Popliteus

Gluteal Region & Back of Thigh

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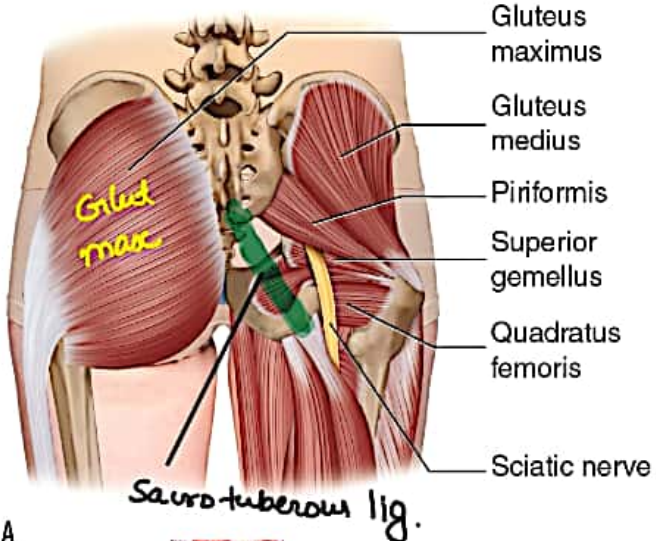
Muscles in gluteal region - Gluteus maximus:

Origin: Ilium
Sacrum
Coccyx
Sacrotuberous ligament

2. Insertion: Gluteal tuberosity ($\frac{1}{4}^{th}$ of muscle fibers)
   Iliotibial tract ($\frac{3}{4}^{th}$ of muscle fibers)

3. Iliotibial tract modification of deep fascia of thigh:
   Gluteus minimus → Anterior surface of greater trochanter
   Gluteus medius → lateral surface of greater trochanter



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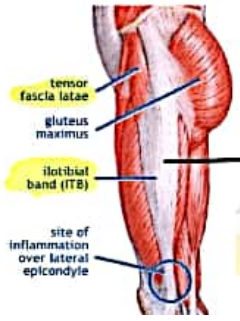

Ilio tibial tract

Small muscles:

A. muscles attached to greater trochanter:
   i) obturator externus → attaches to trochanteric fossa

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ii) Tricipital tendon:
Superior Gemellus muscle + Tendon of obturator internus + Inferior Gemellus
Attached to the area above trochanteric fossa in femur

iii) Piriformis muscle:
Attachments to an inverted turn in greater trochanter

B. Muscles attached to Quadrate Tubercle

iv) Quadratus Femoris:
- Attaches to quadrate tubercle
(Not a part of greater trochanter)

Lesser trochanter
- Iliopsoas muscle

Gluteus minimus-insertion

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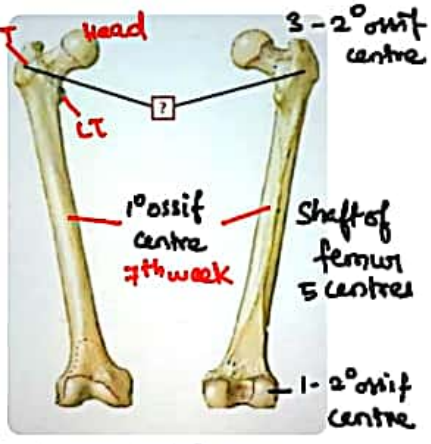
Femur - Ossification centers:

Total of 5 ossification centres
Femur

- Shaft
  - One 1° ossification centre
  - Appear by 7th week
- upper part
  - 3 2° ossification centres
    - Head — 6th month
    - GT — 4yrs
    - LT — 12-14 yrs
- Lower part
  - 1 2° ossification centre
  - 9th month



1. Linea aspara → Prominence in the posterior surface of femur

2. consists of 3 lips:

- Medial
  - i) Spiral line
    - continuation of medial lip
    - Provides attachment to Pectineus
  - ii) Medial lip – attachments
    - medial intermuscular Septum
- Intermediate
  - i) Attachments
    - posterior intermuscular Septum
- Lateral
  - i) Attachments
    - lateral intermuscular Septum

Linea aspera

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3. Gluteal tuberosity:
- Linea aspera (lateral lip) continues above as a prominent tuberosity → Gluteal tuberosity
- Receieves $\frac{1}{4}^{th}$ of Gluteus maximus
- Prominent gluteal tuberosity → 3rd trochonter of femur

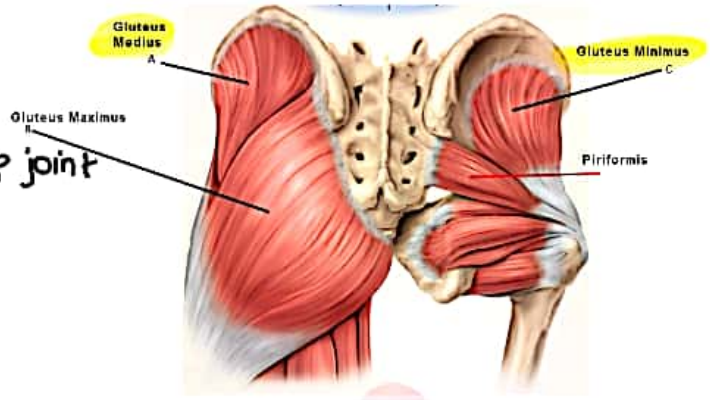
4. Muscles attachments:
A. medial lip:
i) Vastus medialis → medial to medial lip
ii) Adductor brevis (upper) } → Between medial & Intermediate lip
Adductor longus (lower) }
iii) Adductor magnus → lateral to medial lip
B. Intermediate lip:
i) Short head of biceps → Between Posterior & lateral intermuscular Septum
C. Lateral lip:
i) vastus lateralis → lateral to lateral lip

5. Sequential arrangements of structures:

Vastus medialis
↓
Medial intermuscular septum
↓
Adductor brevis
↓
Adductor longus
↓
Adductor magnus
↓
Posterior intermuscular Septum
↓
Short head of biceps femoris
↓
Lateral intermuscular septum
↓
Vastus lateralis

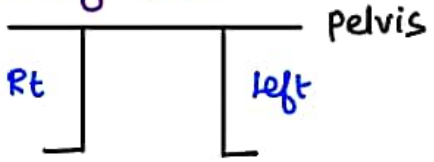
Gluteus medius & minimus - Actions:

Actions:
Gluteus medius & minimus →
Abduction & medial rotation of hip joint



Trendelenberg test:

a)



Both the lower limbs (LL) - on ground

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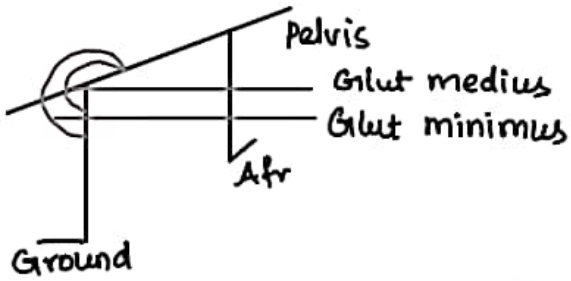
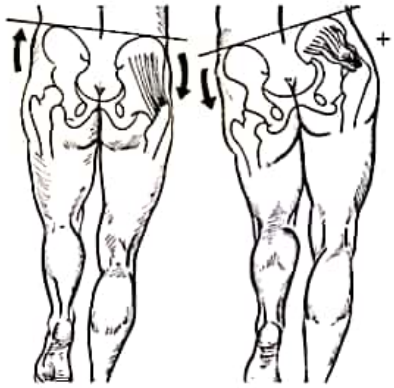
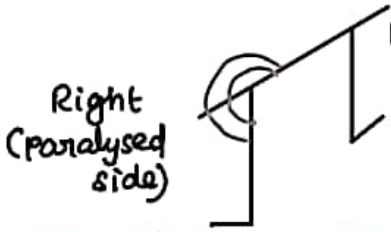
b)





Gluteus medius & minimus → Prevents sinking of unsupported side

c) Injury to Superior gluteal nerve (SGN):



Injury to SGN → sinking of unsupported limb

Trendelenberg Sign:

- Involves
  - muscle → Gluteus medius & minimus
  - Nerve → SGN

Sinking of pelvis on unsupported side when the subject stands on paralysed side.

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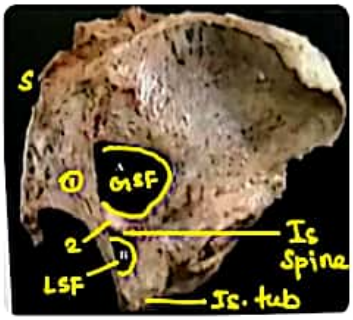
Greater and Lesser Sciatic foramen:

A - Greater Sciatic Notch
B - Lesser Sciatic Notch
1- Sacrotuberous ligament → Sacrum to ischial tuberosity
2 - Sacrospinous ligament → Sacrum to ischial spine

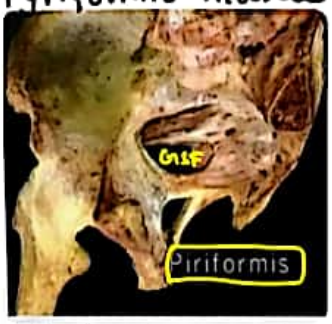
The above ligaments convert greater and lesser sciatic notch to greater & lesser sciatic foramen (LSF).



Pyriformis muscle

Pyriformis muscle:

origin → Ant surface of sacrum
passes through GISF (greater sciatic notch)
Key muscle of gluteal region



Ant view - Sacrum

Structures passing through Greater sciatic foramen: (GISF)

1. Piriformis

Above piriformis

ii) SGN & Superior gluteal vessels

Below piriformis

iii) Inferior gluteal nerve (IGN) & vessels
iv) Sciatic nerve
v) Posterior femoral Cutaneous nerve
vi) Nerve to quadratus femoris
vii) Nerve to obturator internus

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viii) Internal pudendal artery
ix) pudendal nerve

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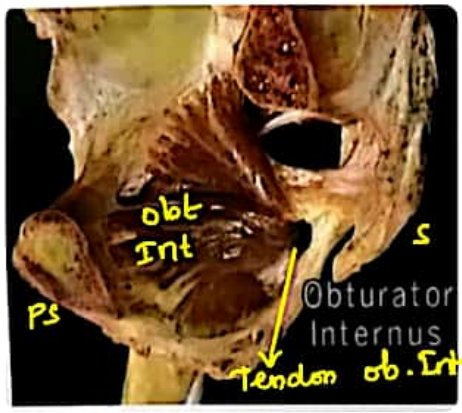
Structures passing through lesser sciatic foramen: (LSF)

(mnemonic - PIN)

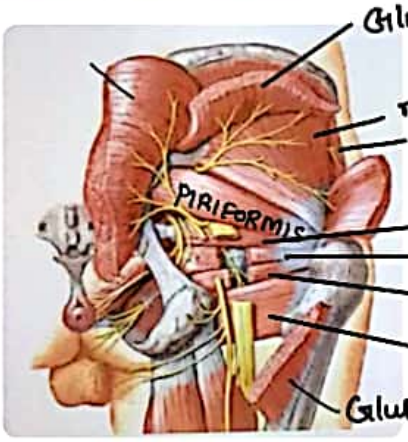
i) Pudendal nerve
ii) Internal pudendal artery
iii) Nerve to obturator internus

} (Reason: in order to reach perineum, they pass through LSF)

iv) Tendon of obturator internus



Lateral pelvic wall:

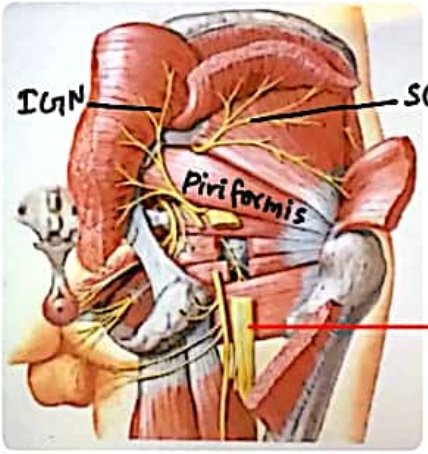


Note: Lateral rotation of femur/hip

1. Prime muscle:
   Gluteus maximus
2. Accessory muscles:
   - Piriformis
   - Sup. gemelli
   - obturator internus
   - Inferior gemelli
   - Quadratus femoris

Nerve Supply of gluteal muscles:

1. SGN (DNB 2018) →
   i) Supplies:
      Tensor fascia
      Gluteus medius
      Gluteus minimus
   ii) Root value – Dorsal division of ventral rami of L_4, L_5, S_1
2. IGN → i) Supplies Gluteus maximus
   ii) Root value - dorsal division of ventral rami of L_5, S_1, S_2
3. Sciatic nerve → i) 2 components (Tibial & common peroneal)
   ii) Thickest nerve in the body



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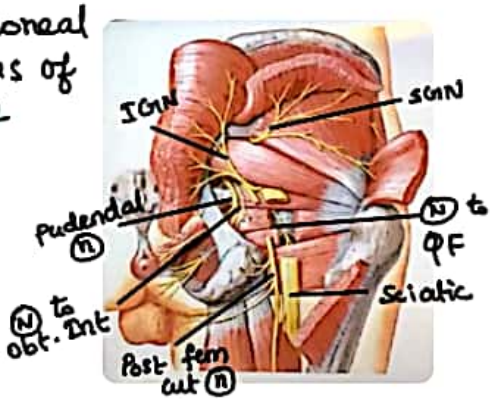
iii) Root value

Tibial
- ventral divisions of L_4, L_5, S_1, S_2, S_3

Common peroneal
- Dorsal divisions of L_4, L_5, S_1, S_2



4. Posterior femoral cutaneous nerve:
   i) Root value - Dorsal division of S_1, S_2
   ventral division of S_2, S_3
5. Nerve to quadratus femoris:
   i) Supplies
   Quadratus femoris
   Inferior gemelli
   ii) Root value - ventral division of ventral rami of L_4, L_5, S_1
6. Nerve to obturator internus:
   i) Root value - ventral division of ventral rami of L_5, S_1, S_2
   ii) Supplies
   obturator internus
   Superior gemelli
7. Pudendal nerve

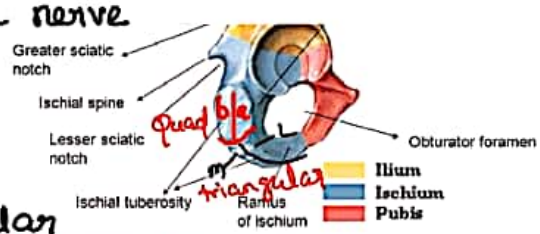
Note:
Tricipital tendon → separates Sciatic nerve from the capsule of the hip joint

Muscles of the back of thigh:

Hamstring muscle:
muscles of the posterior compartment of thigh

1. properties of hamstring muscles:
Origin → Ischial tuberosity
Insertion → Bone of the leg (Tibia / fibula)
Action → Cross the hip joint - Posteriorly & Knee joint - Posteriorly
↓ Hip - Extension
↓ Knee - Flexion
Nerve Supply → Tibial compartment of Sciatic nerve

2. Ischial tuberosity (NEET)



2 parts

Quadrilateral | Oblique line
- a - upper lateral
- b - lower medial

Triangular | Imaginary line
- medial
- lateral

i) Quadrilateral -
upper lateral → origin of Semimembranous
Lower medial → origin of Semitendenosus & Long head of biceps femoris

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ii) Triangular
- medial → Sacro-tuberous ligament

Note: No muscles are attached

- Lateral → origin of hamstring part of adductor magnus

Hamstrings muscles:

muscles:

i) Semi-membranous
ii) Semi-tendinosus
iii) Long head of biceps femoris
iv) Hamstring part/ Ischial part of adductor magnus

1. Biceps femoris:

Long head → a part of hamstrings
Short head → Not a part of hamstrings

Reason:

- origin → Linea aspersa of femur
- Nerve supply → common peroneal nerve - a Component of sciatic nerve

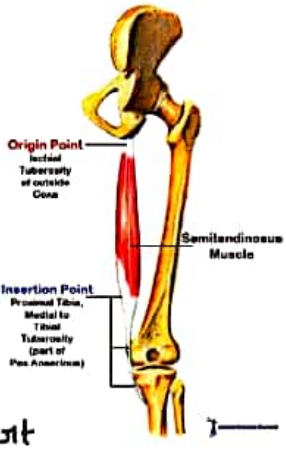
Insertion: both long & short head insert to head of fibula

2. Semitendinosus:

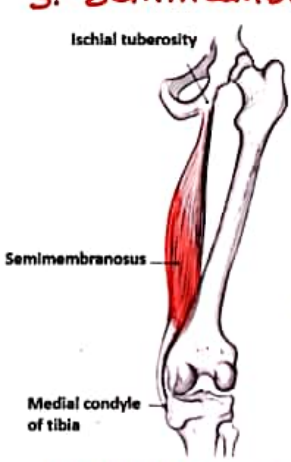
proximal part → Fleshy
Distal part → Tendon

Pes anserinus:

- Sartorius + gracilis + semitendinosus
- also known as Gray ropes



3. Semimembranous:



i). proximal part → membranous
- Distal part → Fleshy

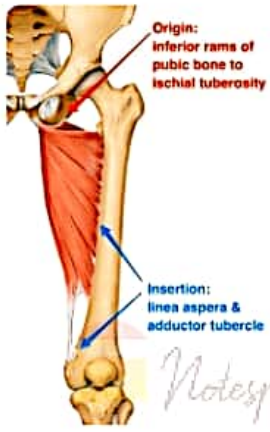
Derivatives of Semimembranous tendon:

ii) oblique popliteal ligament → Extension of Semimembranous tendon
iii) Fascia over popliteal muscle

4. Adductor magnus muscle:

Insertion → Adductor tubercle
- medial collateral ligament →

primitive insertion of adductor magnus



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Knee Joint

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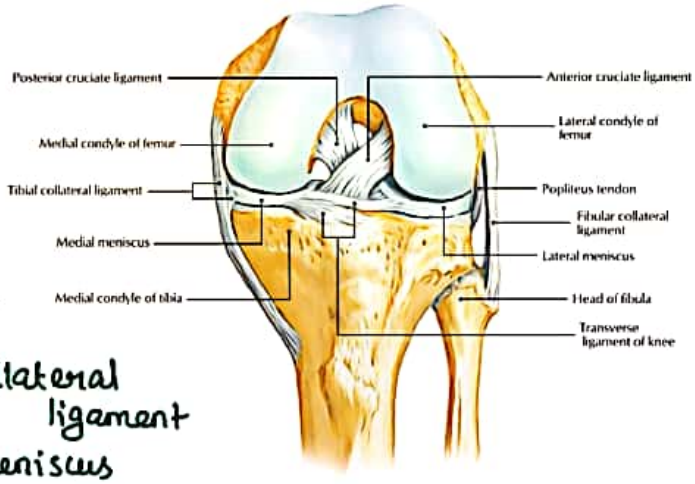
- menisus - Fibrous cartilage
- present b/w femur and tibia
- Function: shock absorbar
- medial collateral ligament is attached to medial menisus
- severe blow on the lateral aspect of knee joint when patient planted his sole firmly on ground, 3 structures are ruptured



Unhappy triad
(or)
Terrible triad
(or)
O' Donoghue triad

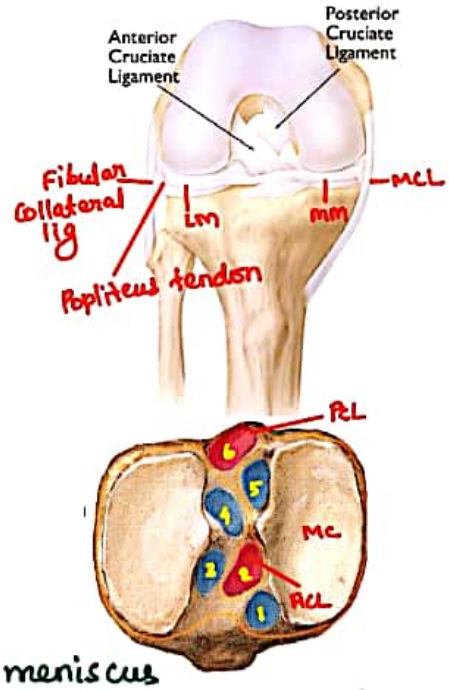
→ medial collateral ligament
→ medial meniscus
→ Anterior cruciate ligament

Fibular collateral ligament:

- also called as lateral collateral ligament
- It is the primitive origin of peroneus longus muscle
- b/w fibular collateral ligament and lateral meniscus popliteus tendon

Applied anatomy:

During knee injury
m/c affected meniscus: medial meniscus
It is immobile/Fixed to surrounding structures
Lateral meniscus is not fixed, It is pulled by popliteus tendon.



MCCULLUM - From anterior to posterior
1. medial meniscus
2. cruciate ligament
3. Lateral menisues (anterior end)
4. Lateral menisus (Posterior end)
5. medial meniscus
6. cruciate ligament

Medial and lateral menisus:

Medial menisus	Lateral meniscus
1) C- shaped	- Almost circular
2) closely attached to medial collateral ligament	- Attached to popliteus
3) mc affected menisus during knee injury - Immobility	- Pulled by popliteus tendon

Cruciate ligaments:

- 2 → Anterior cruciate ligament
  - Posterior cruciate ligament

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- They are intracapsular and Extra synovial [2017 NOV AIIMS]

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Anterior cruciate ligament:

1) Tibial attachment - anterior part of inter-condylar part of tibia
2) Direction
   - upwards
   - Backwards
   - Laterally

   } Tibia to fibula
3) Femur attachment - medial surface of lateral condyle (postero-superior aspect)
4) Function: prevents
   - Anterior displacement of tibia
   - Posterior displacement of femur
5) Taut: During extension of knee joint

Posterior cruciate ligament:

1) Posterior part of intercondylar part of tibia
2) Direction
   - upwards
   - Forwards
   - Medially
3) Antero-Inferior aspect of lateral surface of medial condyle of femur
4) Function's: prevents -
   - Anterior displacement of femur
   - Posterior displacement of tibia
5) Taut: flexion of knee joint

Menisco-Femoral ligament:

- Posterior horn of lateral meniscus is attached to medial condyle
- They are 2 in number
  - Anterior menisco-Femoral ligament (or) ligament of Humphrey
  - posterior menisco-Femoral ligament (or) ligament of wrisberg
- Ganglion of wrisberg - superficial cardiac plexus
- Nerve of wrisberg - Nervus intermedius of Facial nerve
- Ant. menisco femoral ligament passes anterior to PCL
- Post menisco femoral ligament passes posterior to PCL

- Menisco-Tibial ligament
- coronary ligament
- From peripheral margins of medial and lateral meniscus to condyles of tibia

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Anterior and Posterior Compartment of Leg

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Muscles of anterior compartment :

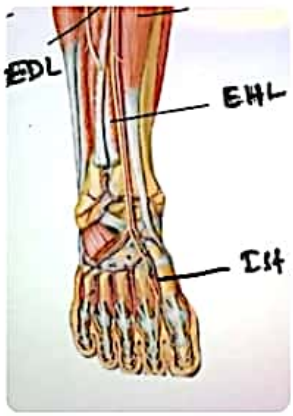
Four muscles - Tibialis anterior (TA)
Extensor digitorum longus (EDL)
Extensor hallucis longus (EHL)
Peroneus tertius - Assist in eversion

Actions - Tibialis anterior, EDL, EHL } cross the ankle joint anteriorly
↓
Dorsiflexion of ankle joint

- Tibialis anterior - also assist in inversion of the subtalar joint
- EHL - Extension of great toe
- EDL - Extension of lateral four toes

Supplied by - Deep peroneal nerve
↓
If injured - dorsiflexion is lost
↓
Foot drop - Deep peroneal nerve injury
> common peroneal nerve injury
(2019 - NEET)

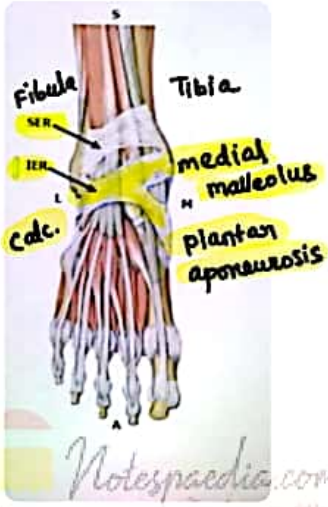
The deep peroneal nerve - also supplies 1st web space in the dorsum



Extensor retinaculum (ER)

Superior ER
↓
Extending from lower end of tibia to lower end of fibula

Inferior ER
↓
It is 'y' shaped
The stem of inferior ER is attached to Calcaneum
↓
and bifurcates into two
↓
upper band, lower band



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↓ Attached to medial malleolus of tibia

↓ blends with plantar aponeurosis

Lateral compartment of leg:

In the lateral compartment

↓

Two muscles – Peroneous longus, Peroneous brevis } Supplied by Superficial peroneal nerve

The Superficial Peroneal nerve – Supplies entire dorsum

↓

Except – 1st web space – Supplied by deep Peroneal nerve [2018 - FMGE]

– lateral aspect of foot – Supplied by sural nerve (branch of tibial nerve)

Saphenous nerve – Branch of femoral nerve

↓

Supplies – upto ball of great toe

Inversion and Eversion movement:

Occurs at subtalar joint & talocalcaneo navicular joint

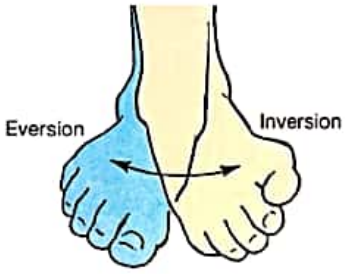
Inversion – medial movement of sole

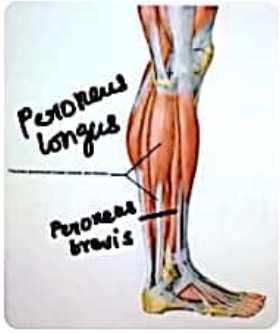
Eversion – Lateral movement of sole

Occurs while walking on uneven surface

Inversion is done by – Tibialis anterior, Tibialis posterior

Eversion is done by – peroneus longus, peroneus brevis





• m/c ligament affected in inversion sprain

↓

Anterior talofibular

Ossification centre for tibia and fibula:

↓

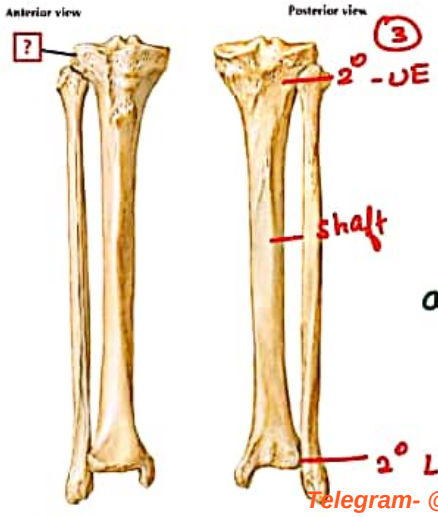
Primary centre

↓

for shaft

↓

appears at 7th week



Secondary centre

↓

For upper end → ↓ appears at the time of birth

For lower end → ↓ appears at 1st year

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Sciatic nerve:

Sciatic nerve - Thickest nerve

- **Tibial component** - ventral divisions of L_4, L_5, S_1, S_2, S_3
- **common peroneal nerve** - Dorsal divisions of L_4, L_5, S_1, S_2

Enters - Gluteal region

↓

By passing below the Piriformis muscle

Sciatic nerve - **Does not Supply** any muscle in gluteal region

Sciatic nerve enters posterior compartment of the thigh

↓

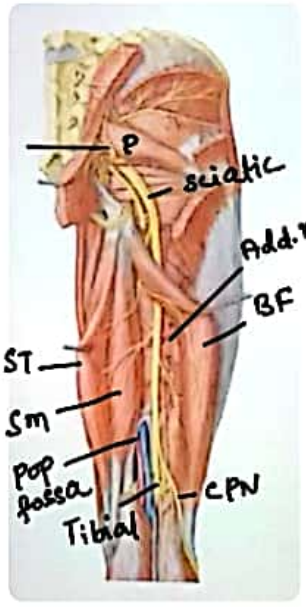
- Supplies - Hamstrings muscles supplied by **tibial component** of sciatic nerve
- **common peroneal component** of sciatic nerve supplies - short head of Biceps femoris

At the upper angle of popliteal fossa - sciatic nerve divides into

Tibial nerve

↓

Nerve of posterior compartment of leg



Common peroneal nerve

↓

It winds around neck of fibula

↓

Divides into

- **Deep peroneal nerve** ↓ Nerve to posterior compartment of leg
- **Superficial peroneal nerve** ↓ Nerve of lateral Compartment of leg

Ankle Joint:

Ankle Joint - Formed by three bones

↓

medial malleolus - Tibia lower end

Lateral malleolus - Fibula lower end

Talus

Sustentaculum tali (ST):

Projection on **medial side** of calcaneum

Supports talus bone - prevents downward displacement of talus bone

Flexor hallucis longus: tendon - pass in the groove present below the ST

Three ligaments are attached of ST - spring ligament, deltoid ligament, talocalcaneal ligament

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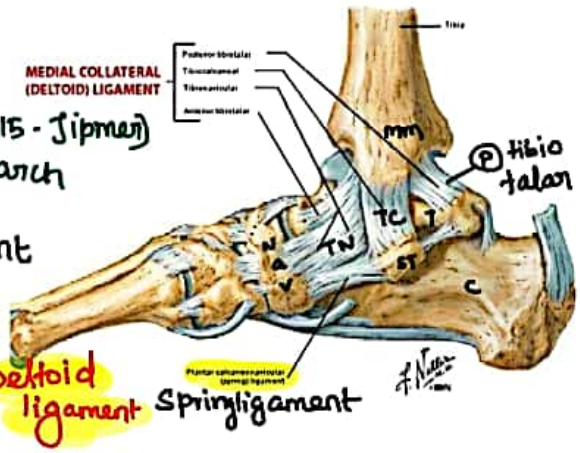
Spring ligament:

- Between sustentaculum of calcaneum to Navicular
- aka plantar calcaneo navicular ligament (2015 - Jipmer)
- supports head of talus, medial longitudinal arch
- Injury - results in flat foot
- Below ankle joint - subtalar joint is present
- Ankle joint - strengthened by two ligaments

↓

medial collateral ligament -aka Deltoid ligament
Lateral collateral ligament -aka Springligament



Deltoid ligament:

Deltoid ligament - strong ligament
Four parts

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Tibionavicular part (TN) (2019-Jip)

↓

Blends with spring ligament

Tibiocalcaneal part (TC)

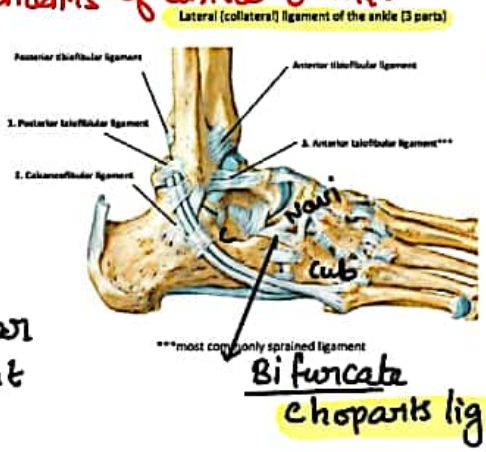
↓

From tibia to ST

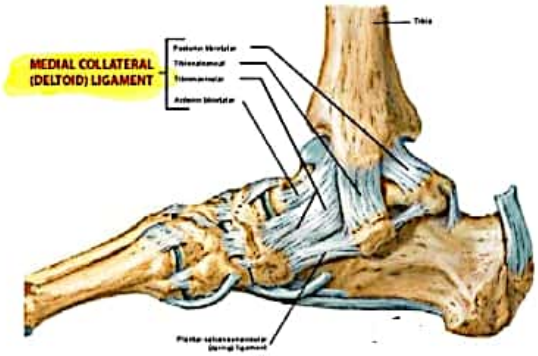
Tibiotalar part (TT)

- Anterior (A)
- Posterior (B)

Lateral collateral ligaments of ankle joint:



1. Anterior talofibular ligament: mlc affected in inversion sprain
2. Calcaneo fibular ligament
3. Posterior talo fibular ligament



Bifurcate ligament:

aka choparts ligament
ligament of calcaneo cuboidal joint

↓

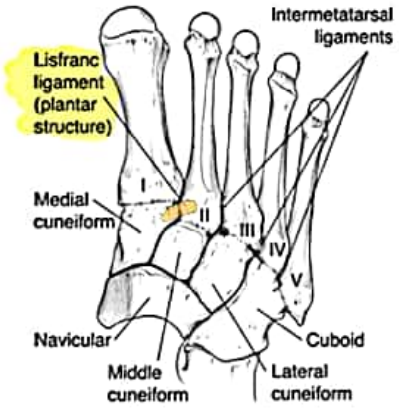
proximally - Attached to Calcaneum
distally - Calcaneonavicular & Calcaneo cuboid

Lisfrans ligament:

Known as cuneo-metatarsal interosseous ligament

↓

Extends from medial cuneiform to 2nd metatarsal



Posterior compartment of leg - Superficial layer:

- muscles G - Gastrocnemius
  P - Plantaries
  S - Soleus

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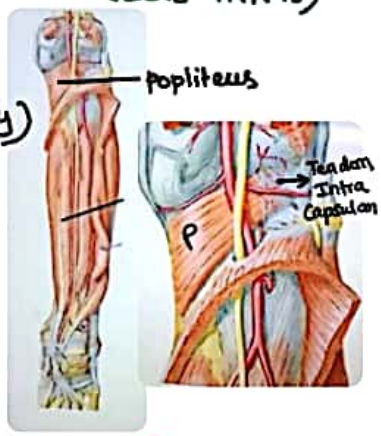
Gastrocnemius - Has two heads
↓
Joins with Soleus
↓
Forms Triceps Surae
↓
Forms Achilles tendon or tendocalcaneus
↓
Attached to calcaneum

The plantaries muscle tendon is attached to achilles tendon
In the superficial posterior compartment - no neurovascular structures seen (2018 - AIIMS)

Posterior compartment of leg - Deep layer:

1) popliteus muscle - tendon is intracapsular
Action - flexion of knee joint (cross knee joint posteriorly)
↓
Initiates unlocking of knee joint
Nerve Supply: tibial nerve

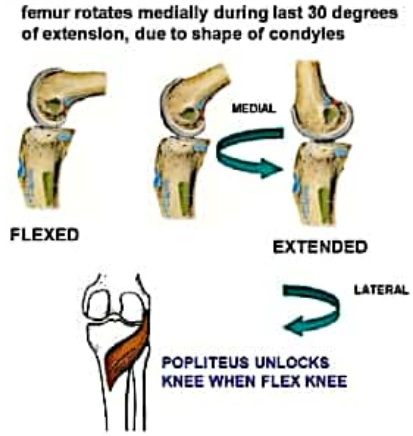


Locking and unlocking of knee joint:

Locking of knee joint
↓
- done by Quadriceps femoris
- Extension of knee
- when the foot is on the ground
↓
The femoral condyle rotates medially / Internally over the tibia

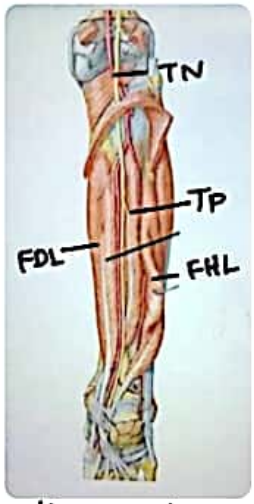
Unlocking of knee joint
↓
It is done by popliteus

Flexion of knee joint
when the foot is on the ground, the femur rotates laterally / externally over the tibia



Deep layer of posterior compartment - other muscles:

FHL - Flexor hallicus longus
FDL - Flexor digitorum longus
TP - Tibialis posterior



Flexor hallucis longus (FHL)
Flexor digitorum longus (FDL)
Tibialis posterior (TP)
} crosses the ankle joint posteriorly
↓
Action - Plantar flexion

Tibialis posterior - Assist in inversion of subtalar joint
FDL - Flexion of lateral four toes
FHL - Flexion of great toe

Flexor Retinaculum:

It is attached between medial malleolus and Calcaneum and

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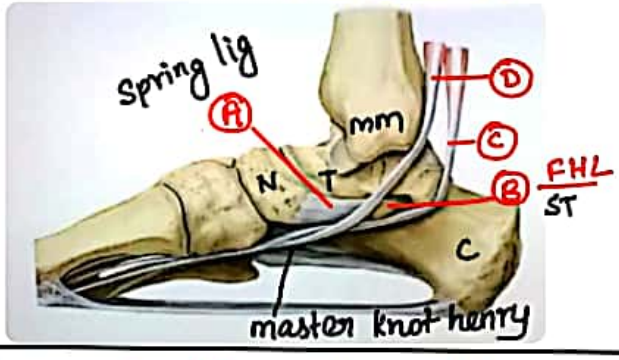
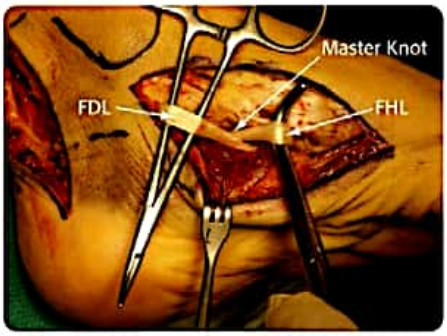
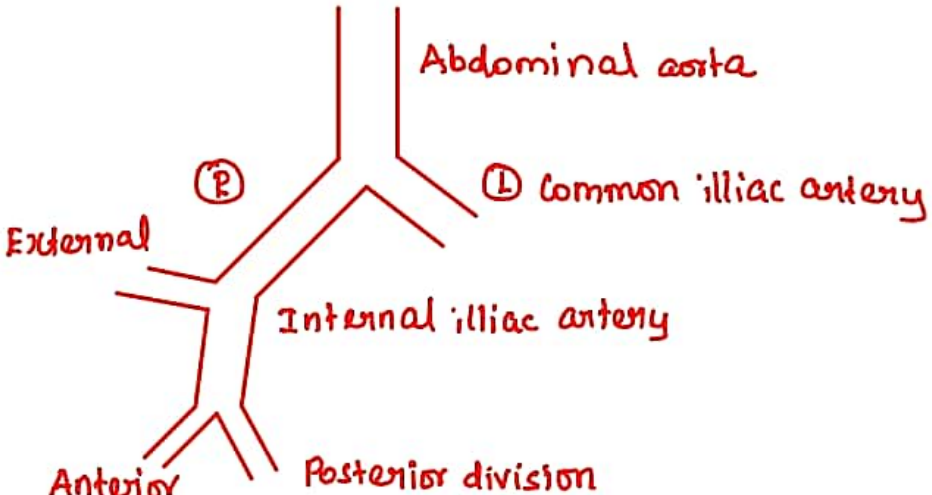
Structures passing below the FR
↓
Forms medial side to lateral side
↓
1. Tibialis posterior
2. FDL
3. Posterior tibial artery and nerve
4. FHL

The Tibial nerve - Supplies all the muscles in posterior compartment
In the sole, it is divided into medial plantar nerve and lateral plantar nerve
It gives sensory and motor supply to the sole
In the tarsal tunnel syndrome - tibial nerve is affected
The FDL tendon and FHL tendon are crossing over the navicular bone
↓
In synovial sheath inflammation of these two tendons
↓
Compress medial plantar nerve in the "master knot by Henry"





Blood Supply, Arches & Sole of foot



↓
Superior Gluteal artery
Ilio lumbar arter
Lateral saural
mnemonic - SILK

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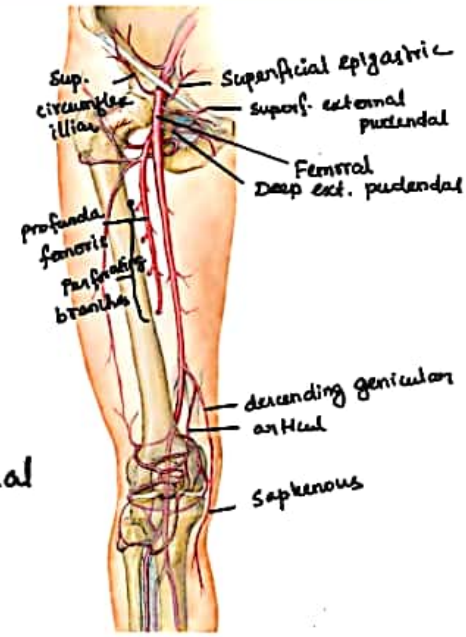
Note: Inferior Gluteal artery a branch of anterior division

Arterial Supply: Thigh

- Femoral artery: course
- External illiac artery continues as femoral artery at mid inguinal point
  Femoral triangle – F. artery enters lateral compartment of femoral sheath
- Femoral sheath – 3 compartments
  lateral – F. artery, intermediate – F. vein, medial – F. canal.
- Boundaries of femoral ring:
  anterior: inguinal ligament
  Posterior: pectineus muscle & pectineal ligament of cooper
  Medial – lacunar ligament
  Lateral – F. vein



↓

Adductor canal

↓

Adductor hiatus → Enters back of knee joint → Popliteal artery

Branches of femoral artery:

Branches of profunda femoris:
a. medial circumflex femoral
b. Lateral circumflex femoral
c. perforating branches

Perforating branches: 4 in number
i) Cruciate anastomosis
ii) Nutrient branch of femur
iii) Descending Genicular branch
iv) Anastamose with popliteal artery

Desending Genicular branch – Just before passing through adductor canal
- Saphenous branch
- Articular branch → Anastamosis at knee joint

Lower limb: anastomosis:

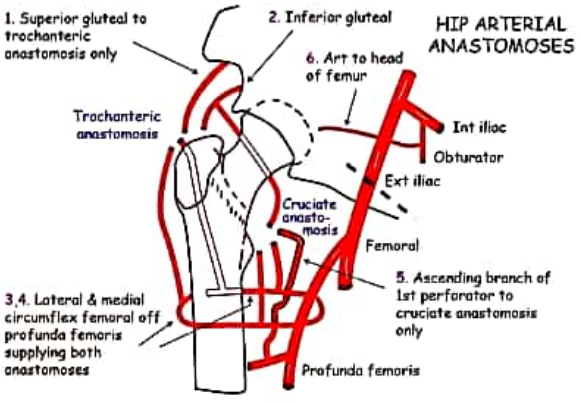
1. Trochanteric Anastomosis → Anastomosis between External iliac & Internal iliac artery

↓

- Superior gluteal] branches of internal illiac artery
- Inferior gluteal]
- Medial circumflex femoral] branches of profunda femoris
- Lateral circumflex femoral]

↑ Femoral artery

↑ External iliac artery



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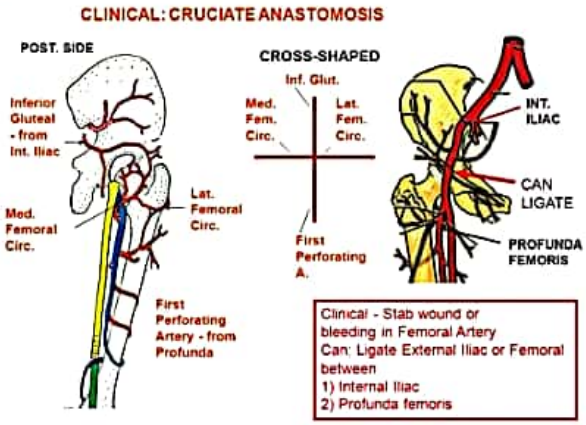
2. Cruciate anastomosis:

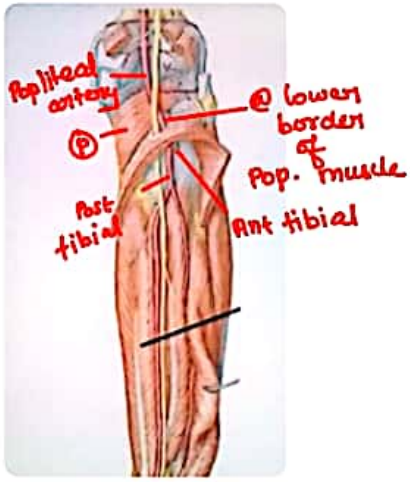


Arteries involved:
- Inf. Gluteal artery
- Medial & circumflex femoral
- Lateral
- 1st perforating artery

- artery not involved
  - superior gluteal artery

Arterial Supply: Leg

- Back of knee joint: Femoral artery continues as popliteal artery in popliteal fossa

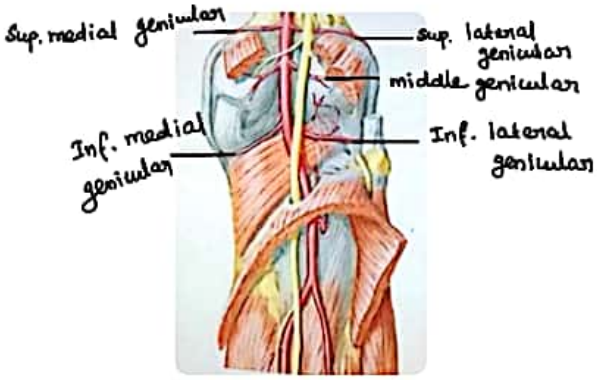


Popliteal artery
↓
Divides at the lower border of popliteus muscle

Anterior tibial artery	Posterior tibial artery
↓	↓
Anterior compartment of leg	Posterior compartment of leg

Popliteal artery: branches

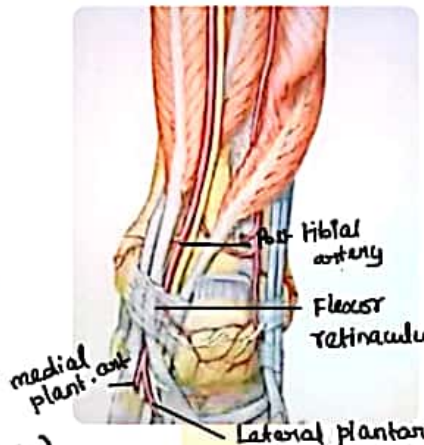
A. 5 Genicular branches
- SMG, SLG, IMG, ILG
- middle genicular branch pierces oblique popliteal ligament a derivative of semimembranos



B. Posterior tibial artery:

- Branches
  peroneal artery / fibular artery
  ↓
  Supplies lateral compartment of leg
- Superficial peroneal nerve → Supplies lateral compartment of leg
- Nerve to lateral compartment of leg
  ↓
  Superficial peroneal nerve

- Peroneal artery → Nutrient branch of fibula
- posterior tibial artery
  ↓
  Nutrient branch to tibia
  (Tibial nutrient foramen on posterior surface)



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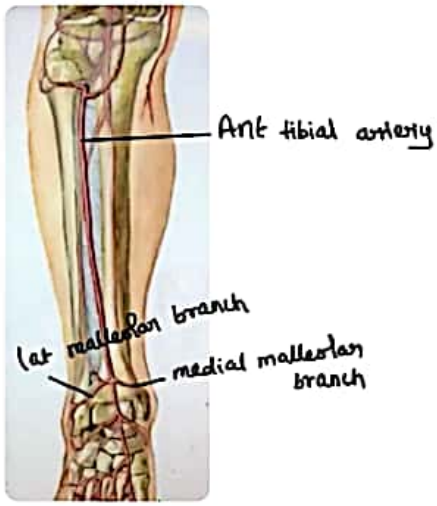
- Posterior tibial artery
  ↓
  Passes through flexor retinaculum
  ↓
  Enters the foot
  ↙ ↘
  Medial (plantar artery) lateral

c. Anterior tibial artery :
- Pass above Interosseous membrane
- Artery for anterior compartment of leg
- Branches
  - Medial } malleolar branch
  - lateral }
- Continues in foot as Dorsalis pedis artery (at the junction of malleolar branches

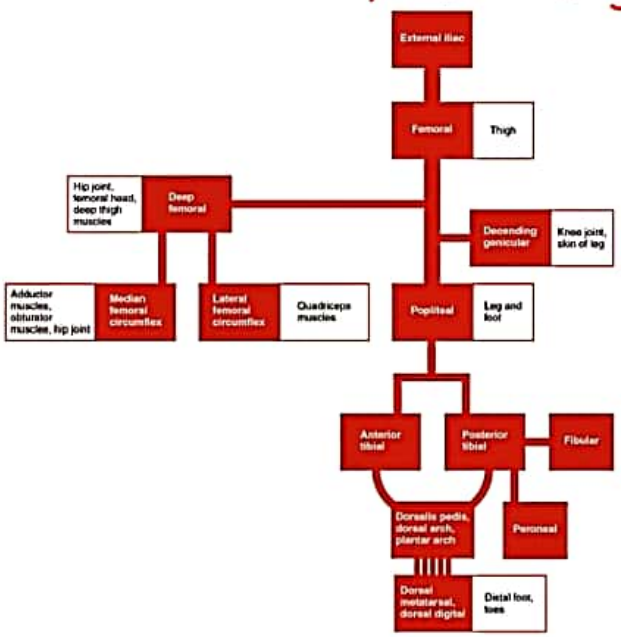


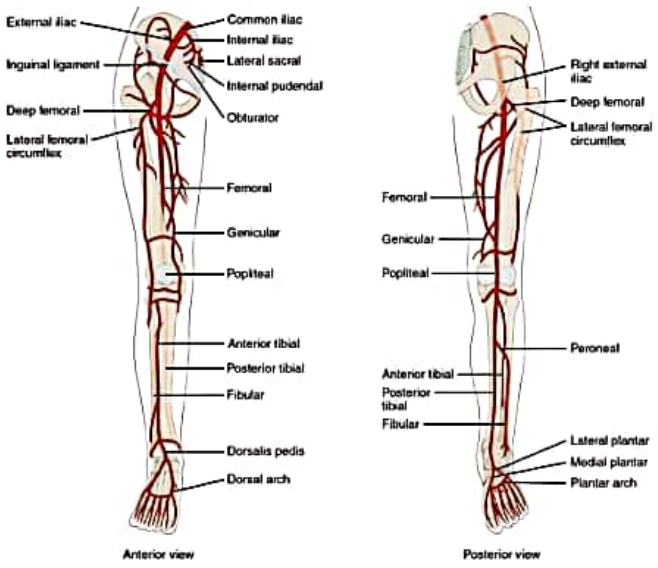
Arterial Supply : Foot
- Dorsalis pedis artery

Branch :
- medial tarsal artery
- Lateral Tarsal artery
- Arcuate artery
- 1st Dorsal metatarsal artery

Enter the sole - passing through Triangular gap of 1st dorsal interosseus

Plantar arch → Dorsalis pedis artery
+
Lateral plantar artery





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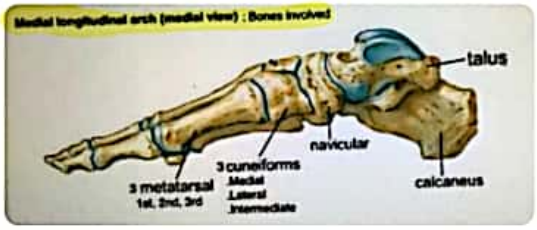
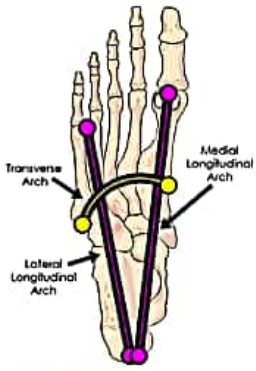
Arches of foot :

1. longitudinal arch
   - Medial
   - lateral
2. Transverse arch

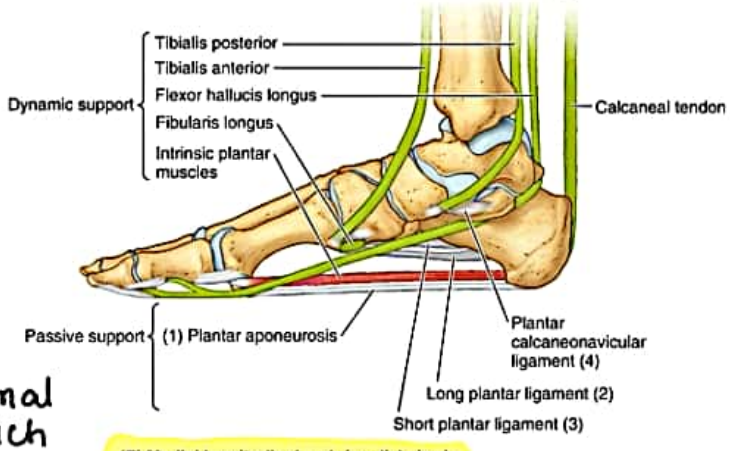




A. medial longitudinal Arch:

Keystone / summit / peak of medial longitudinal arch → Talus

- Joint of the arch →
  Talo- calcaneo-navicular joint
  (Ball & Socket joint)
  ↑
  Incus & Stapes



(E) Medial longitudinal arch (medial view)

- plantar Calcaneonavicular ligament
  also known as spring ligament
  main support of medial longitudinal arch

- Sling support to medial longitudinal arch
  major support
  Tibialis posterior } Action - Inversion
  Tibialis anterior }
  Minor support :
  Flexor hallucis longus (FHL)
  Flexor digitorum longus (FDL)

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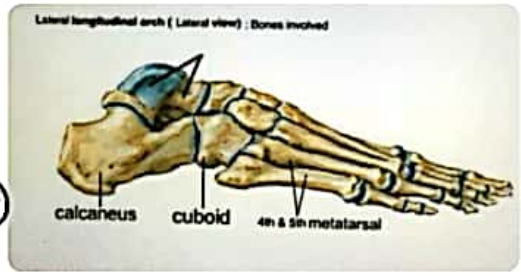
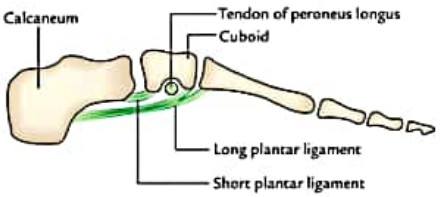
Lateral longitudinal arch:



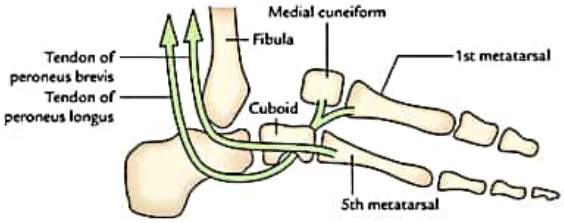
Summit / peak / keystone → calcaneum
Joint of the arch → calcaneocuboid arch
(saddle type of synovial joint)

Support to lateral longitudinal arch :
- long plantar ligament (plantar calcaneo-metatarsal ligament)
- short plantar ligament (plantar calcaneo-cuboid ligament)



Sling support:
- Tendon of peroneus brevis
- Tendon of peroneus longus

Action - Eversion



Sole of the Foot:

- muscles are arranged in 4 layers

1st layer: Abductor muscles
- Abductor Hallucis (medial plantar nerve) (MPN)
- Abductor Digiti minimi (lateral Plantar nerve) (LPN)

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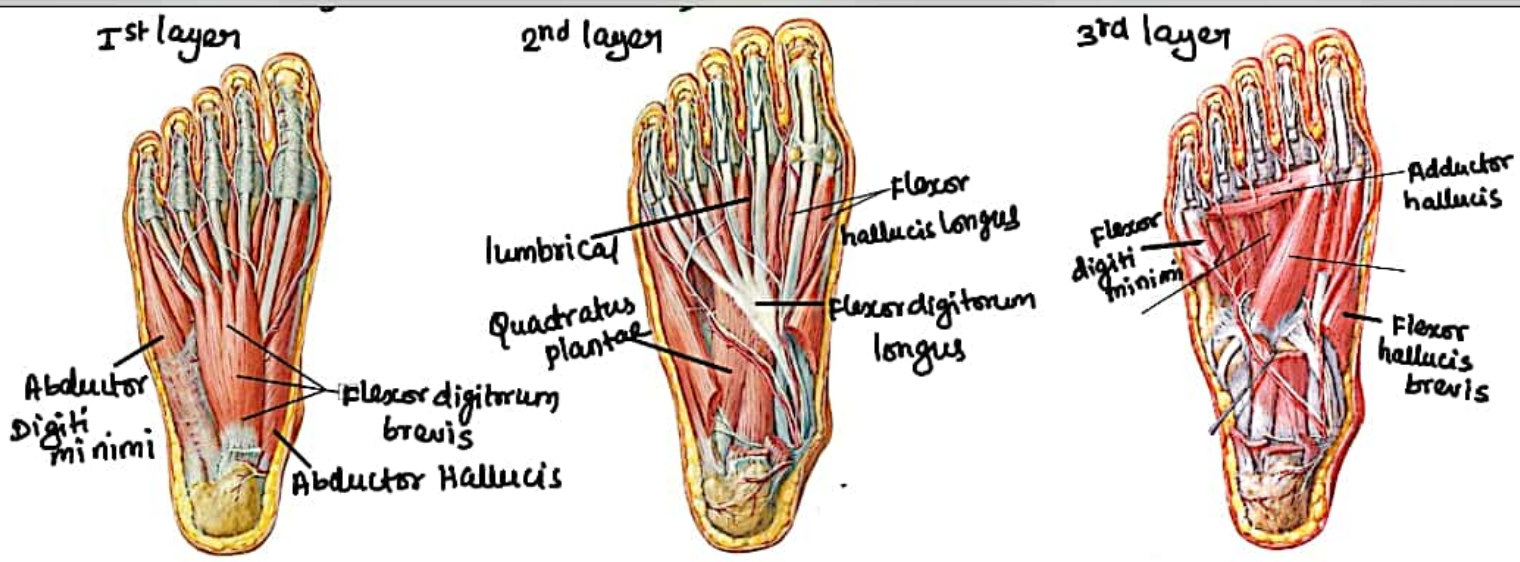

2nd layer: 2 Tendons, 2 muscles → • Lumbricals
↓ (1st (MPN) - unipennate 2,3,4 – bipennate)
FDL • Quadratus plantae (LPN)
FHL

3rd layer: 2 flexor muscles –
Flexor digiti minimi (CPN)
Flexor hallucis brevis (MPN)
Adductor hallucis (LPN)

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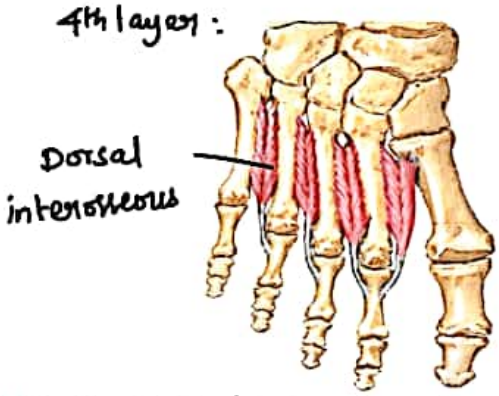
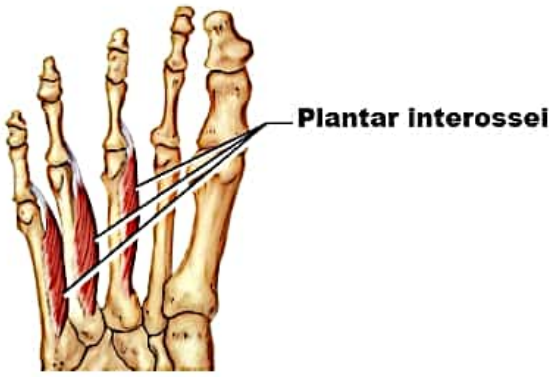
4th layer:
Dorsal Interosseus (Bipennate) → 4 in number
palmar Interosseus (unipennate) → 3 in number





Muscles Supplied by medial plantar nerve: Foot
- Lumbrical 1
- Abductor Hallucis
- Flexor Hallucis brevis
- Flexor Digitorum brevis

muscles supplied by median nerve in palm
- Lumbricals
- Opponens pollicis
- Abductor pollicis brevis
- Flexor pollicis brevis

Applied anatomy:

1. Morton's Neuroma:
   - most common form of nerve entrapment in foot
   - Entrapment of 3rd common digital nerve (branch of plantar nerve)
   - Pain in 3rd web space

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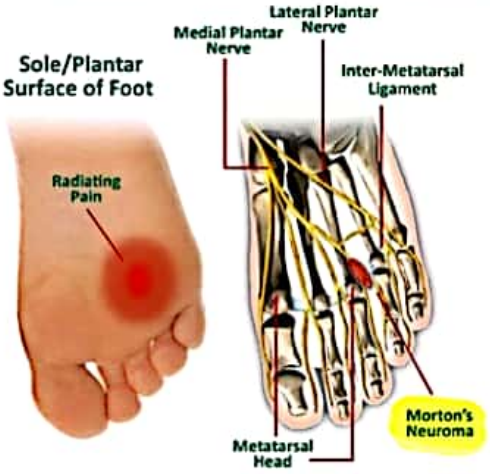
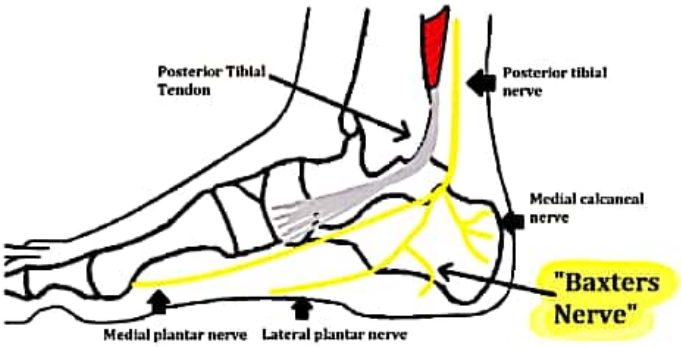


2. Baxter's Neuropathy :



Entrapement of Baxters Nerve → 1st branch of lateral plantar nerve

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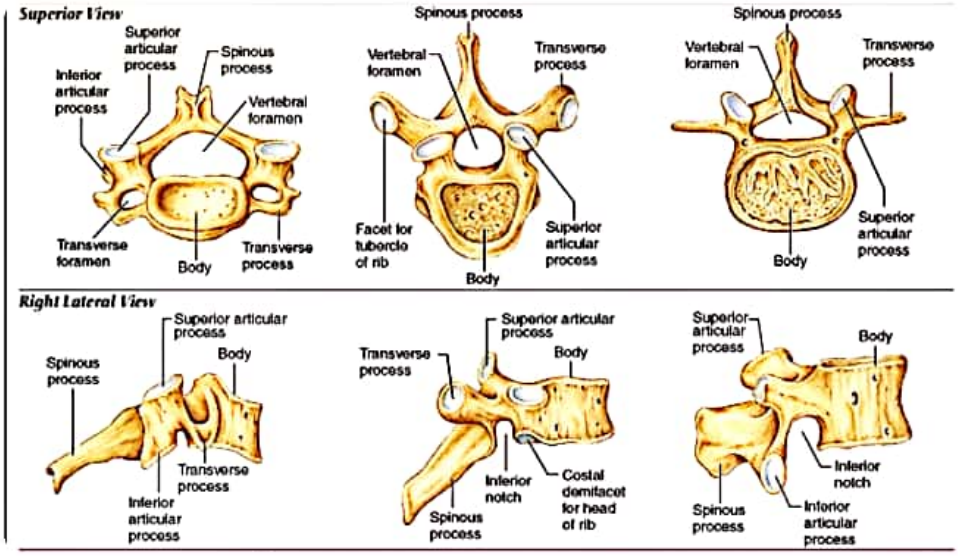
BACK

Vertebra:

- 30 vertebrae (C=7; T=12; L=5; S=5; coccyx:1)



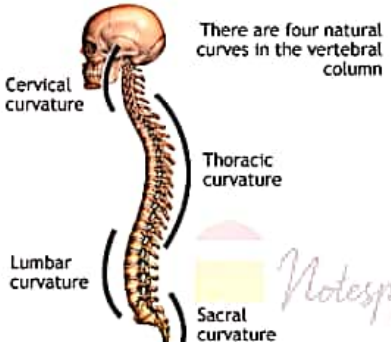
Different features of vertebrae:

Feature	Cervical	Thoracic	Lumbar
- Body	Small / circular	Heart shaped	massive / Bean Shaped
- vertebral canal	Triangular	Circular	Triangular
- Identifying feature	Foramen transversium (FT)	costal demifacet present	NO FT / NO costal demifacet
- Superior art. facet	upwards and backwards	upwards, backward & laterally	medially
Spine	Bifid	Inclining downward	Backwards

Curvatures of vertebral Column, C_1 & C_2 vertebra:

- primary curvature - Before birth - Thoracic & Sacral - Kyphosis
- secondary curvatures - After birth - Cervical & Lumbar - Lordosis

Mnemonic: KFC - TaSty
- K - Kyphosis
- F - Fetal (primary)
- C - Curvature
- T - Thoracic
- S - Sacral



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C_1 vertebra:

- Atlas - no body
- Transverse ligament connects the 2 lateral masses
- Groove for vertebral artery

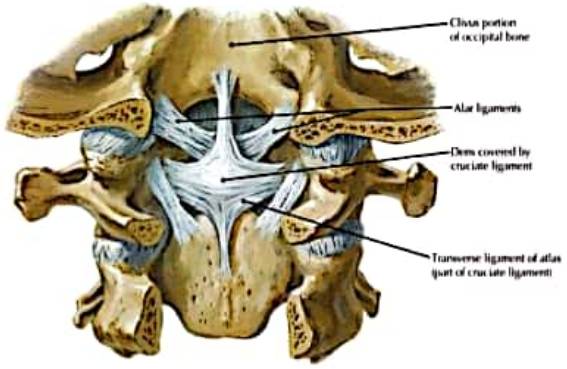
C_2 - vertebra:

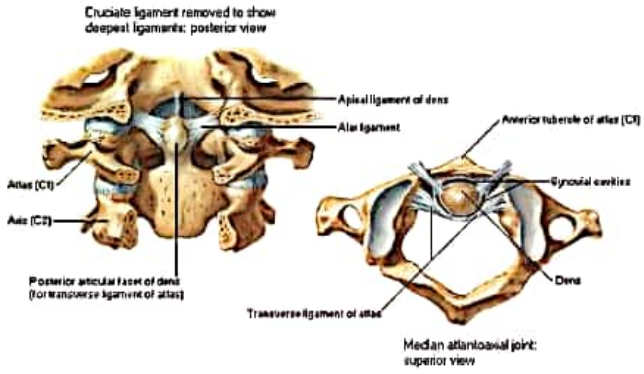
- Axis
- Dens +
- Atlas and axis are connected by atlantoaxial joint - Pivot joint
- Transverse ligament maintains the atlandoaxial joint
- Side to side movement of head - altalando axial joint

Cranio-axial ligaments:

1. Cruciate ligament: consists of transverse ligament & longitudinal ligament
   - Superior longitudinal ligament - Dens to occiput bone
   - Inferior longitudinal ligament - Dens to axis
2. Apical ligament of dens - Dens to occiput bone
3. Alar ligament of dens - Dens to occiput condyles
4. Posterior longitudinal ligament - continuation of tectorial membrane

Ligaments passing through foramen magnum:





1. membrana tectoria
2. Apical ligament of dens
3. Superior longitudinal band

Atlando occipital joint:

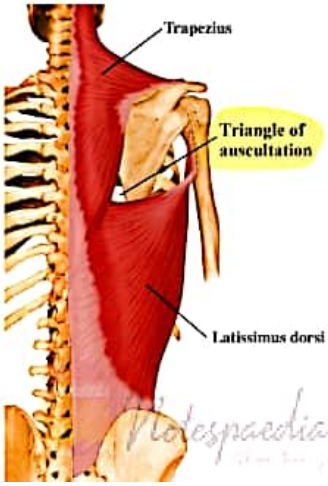
- Ellipsoid joint > condylar
- 'yes' movement - Flexion & extension of neck

Triangle of auscultation and lumbar triangle:

Triangle of auscultation:

Boundaries:

medial - Trapezius
lateral - medial border of scapula
Base - Lattismus dorsi



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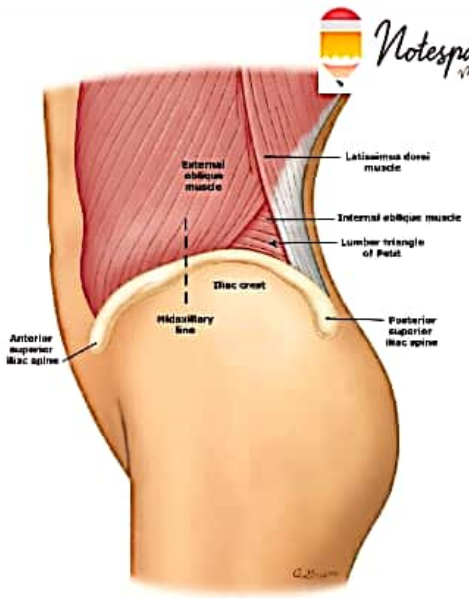
used for auscultation of lung sounds and cardiac orifice



Lumbar Triangle of petit:

Boundaries:

- Anterior - External oblique
- Posterior - Lattismus dorsi
- Base - iliac crest

Potential site for internal hernia

Note:

Lattismus dorsi - Forms boundary for both Lumbar triangle and Triangle of Auscultation

Spinal segments:

	vertebra	nerves	
cervical	7	8	→ 31 pairs
Thoracic	12	12	
Lumbar	5	5	
Sacrum	5	5	
Coccyx	1	1	

- Spinal nerves upto C_7 - pass above the corresponding vertebra
- After that, they pass below the corresponding vertebra

Spinal segments:

Part of the spinal cord to which the spinal nerves are attached

vertebra	Spinal Segment
cervical	Add +1
$T_1 - T_5$	Add +2
$T_6 - T_9$	Add +3
T_{10}	L_1, L_2
T_{11}	L_3, L_4
T_{12}	L_5
L_1	Sacral & coccygeal

Lumbar puncture:

- Done at the level of L_4-L_5 (Level - highest point of iliac crest)
- Can also be done at L_3-L_4

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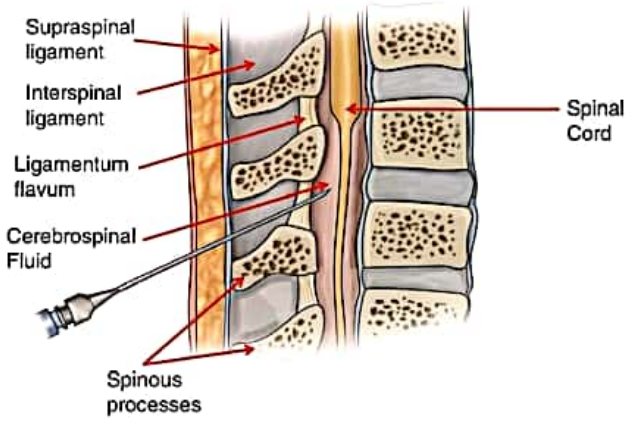
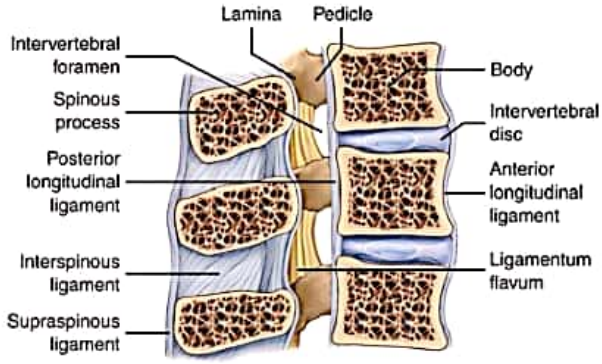
Structures pierced during lumbar puncture:

1. Supraspinous ligament
2. Interspinous ligament
3. Ligamentum flavum - "Feeling of giving way" or "popping sensation"
4. Dura - give the way feeling
5. Arachnoid mater





GENERAL ANATOMY

Type of Bones:

1) Long bones :
   - 2 ends (epiphyses) + 1 shaft
   - medullary cavity
   - ossified by cartilage
   - eg. Humerus, Radius, Fibula
   - miniature long bones
   - only one epiphysis
   - eg. metacarpal
   - modified long bones
   - Horizontally placed
   - No medullary cavity
   - ossifies by membrane
   - eg. clavicle

2. Short Bones :
   - Named according to their shapes
   - eg. Carpal bones, Tarsal bones (Trapezium, cuboid)

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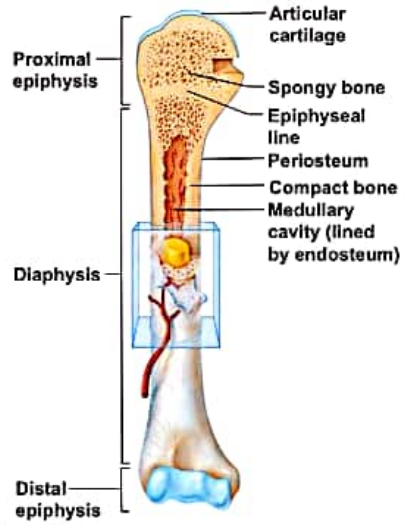
3. Flat bones:
   - Protective in function
   - eg. Bones of thoracic cage and Cranial vault

4. Irregular bones:
   - eg. Hip bone

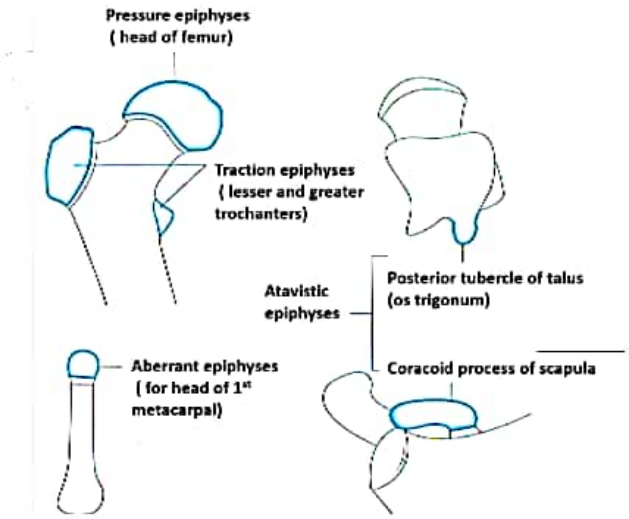
5. Pneumatic bones:
   - Air filled cavities
   - maxillary, Frontal, ethmoid, Sphenoid Sinus bones
     mastoid (Temporal bone)

6. Sesamoid bones:
   Bone are formed in tendons
   - Patella - Quadriceps femoris
   - Pissiform - Flexor Carpi Ulnaris
   - Riders bone - Adductor longus
   - Fabella bone - Lateral head of gastrocnemius

Metaphysis:
   - Epiphyseal end of diaphysis
   - Highly vascular



Type of Epiphysis and Nutrient artery:



Type of epiphysis:

1) Pressure epiphysis:
   - joint foramen
   - Transmit weight

2) Traction epiphysis:
   - Not involved in joint formation
   - Formed due to pull of muscles
   - Eg. Lesser and greater trochanters

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3) Atavastic epiphysis:

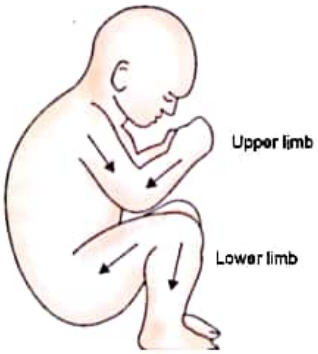
- Fused to surrounding bones mainly for nutrition
- eg. coracoid process of scapula
  posterior tubercle of talus (os trigonum)

4) Aberrant epiphysis:
- Not usually present
- eg. Head of 1st metacarpal bone
  Base of remaining metacarpal bone

Nutrient artery:

Supplies:
- medullary cavity
- Inner 2/3rd of cortex
- metaphysis

Direction of nutrient artery
- mnemonic
  "To the elbow I go, from the knee I flee"



Growing end in upper limb
- upper part of Humerus
- Lower part of Radius and ulna

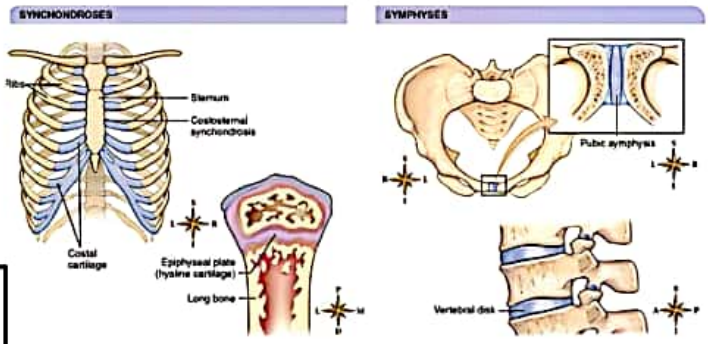
Growing end in lower limb:
- Lower end of femur
- upper end of tibia and fibula

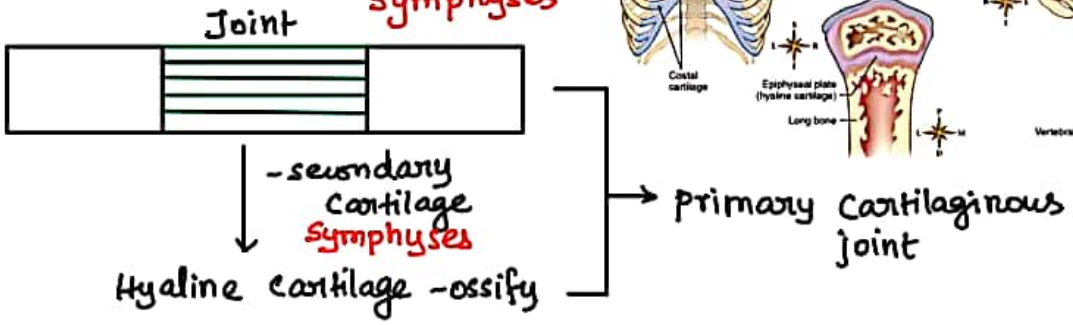
List of nutrient arteries:

Humerus - profunda brachii artery
Radius, Ulna - Anterior interosseous artery
Femur - profunda femoral artery
Tibia - posterior tibial artery
Fibula - peroneal artery (branch of : Posterior tibial artery)

Type of joints:

1) Cartilaginous joint:
- primary cartilaginous joint: Synchondroses
- Secondary cartilaginous joint: Symphyses





Primary Cartilaginous joints are temporary joints
eg. 1) joint between epiphysis and diaphysis
2) costochondral joints

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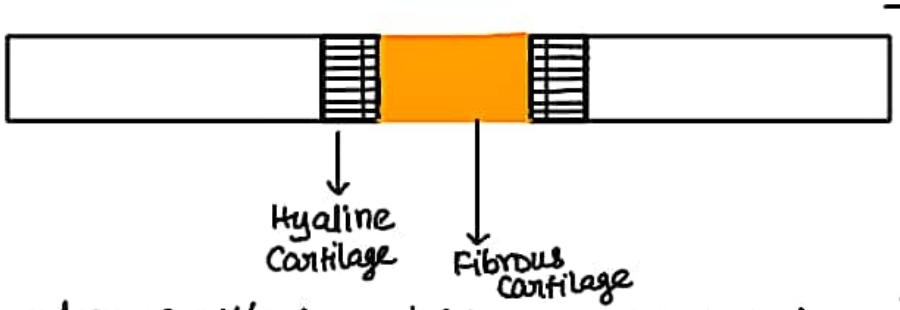
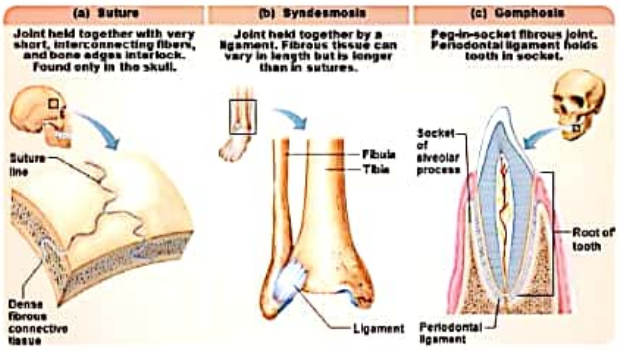


Secondary cartilaginous joints are permanent
eg. All midline joints like pubic symphysis, symphysis menti, manubriosternal joint etc.

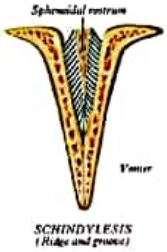


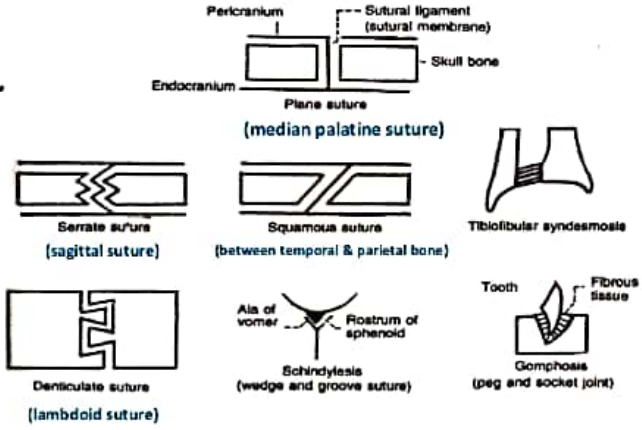
2) Fibrous joint:

a) Suture:

Type of Sutures:

- plane suture: median palatine suture
- serrate suture: Saggital suture
- Squamous suture: Between temporal and parietal bone
- Denticulate suture: Lamboid suture
- Schindylesis: wedge and groove suture
  special type of suture
  Between ala of vomer and Rostum of sphenoid





b) Syndesmosis:

Inferior tibio-fibular joint

c) Gomphosis:

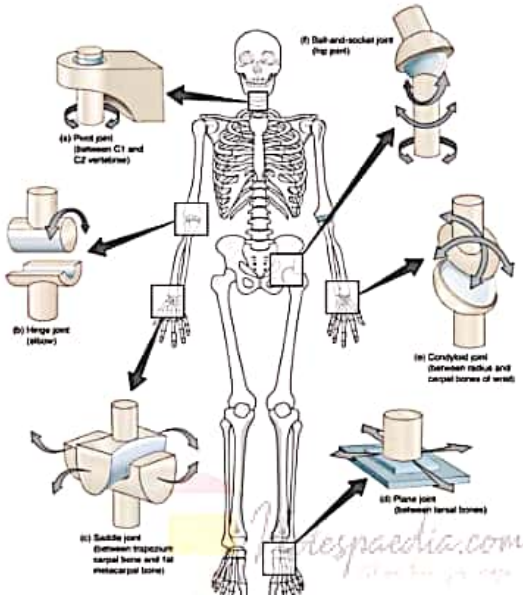
periodontal ligament

Other type of joints:

Synovial joint:

Types:

- Plane: Inter carpal joints
  Inter tarsal joints
  Chondro sternal joints
  Costo cervical joints
  Facet joint (zygapophyseal joints)
- Hinge: Flexion and extension
  eg. elbow joint
  Ankle joint
  Interphalangeal joint



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Pivot : Rotation
eg. Atlando- axial joint
Radio - ulnar joint

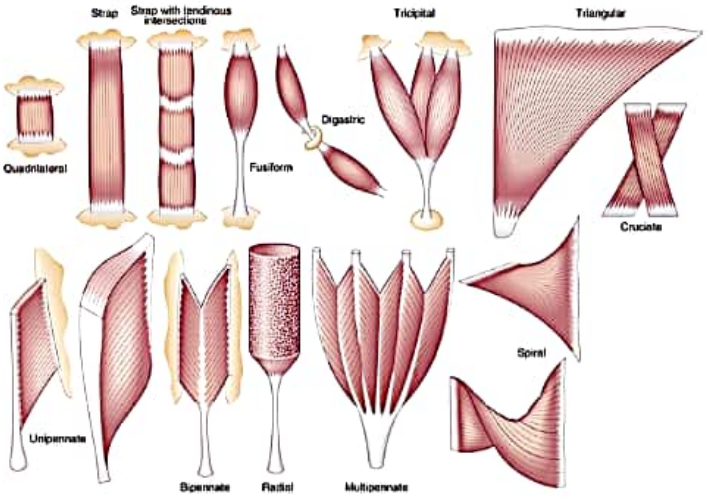
Condyloid : condyles in head
eg. Tempero- mandibular joint
Knee joint

Ellipsoid : Elliptical joints
eg. wrist joint
knuckle joint
Atlando occipital joint

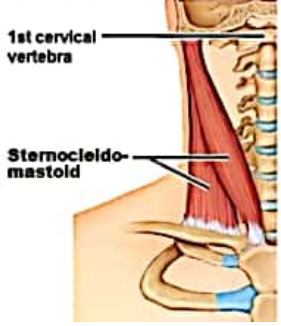
Saddle : Reciprocally convexo- concave
eg. 1st carpo metacarpal joint
sterno - clavicular joint
malleus - incus joint
Calcaneo- cuboid joint

Ball and Socket : multi axial
eg. Hip joint
shoulder joint
Incus - stapes joint
Talo -calcaneo navicular joint

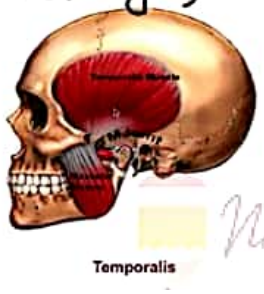
Muscles:
Origin: Fixed
Insertion : movable
Muscle shapes:
-Quadrilateral : Pronator Quadratus
Thyrohyoid
-Strap: Infrahyoid
-Strap with tendinous intersections:
Rectus abdominis
- Fusiform : Biceps
Digastric
- Spiral / twisted fasciculli : Trapezius
Lattismus dorsi



- Cruciate fasiculi : Sternocleidomastoid



- Convergent Fasciculus : Temporalis
(broad orgin)



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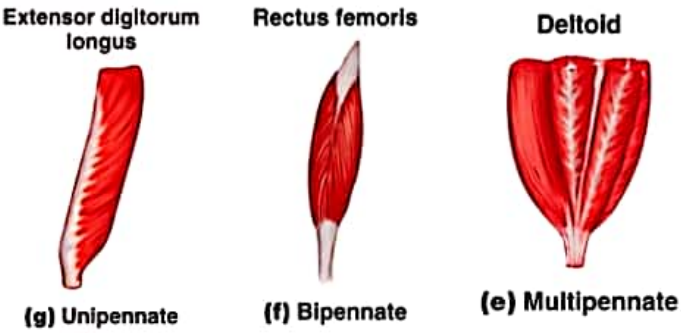
- Unipennate : Extensor digitorum longus
  Flexor pollicis longus
  palmar interosseous
  Lumbricals 1,2
- Bipennate : Rectus femoris
  Flexor Hallucis longus
  Peroneus longus
  Dorsal interosseous
  Lumbricals 3,4
- Multipennate : Deltoid
  Tibialis anterior
  Subscapularis



Hybrid muscles:
- 2 nerve Supplies
- Digastric : Anterior - nerve to mylohyoid
  Posterior - Facial nerve
- Levator Scapulae : C_3-C_4
  Dorsal scapular nerve
- Subscapularis : upper and lower scapular nerve
- Brachialis : musculocutaneous nerve
  Radial nerve
- FDP : Anterior interosseous nerve
  Ulnar nerve
- FPB : Median nerve
  Ulnar nerve
- Pectoralis major : medial and lateral pectoral nerve
- Adductor magnus : Obturator nerve
  Tibial component of sciatic nerve
- Pectineus : Femoral nerve
  Obturator nerve
- Biceps Femoris : Tibial Component
  Common peroneal nerve Component

(Pectineus, Biceps Femoris — Sciatic nerve)

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